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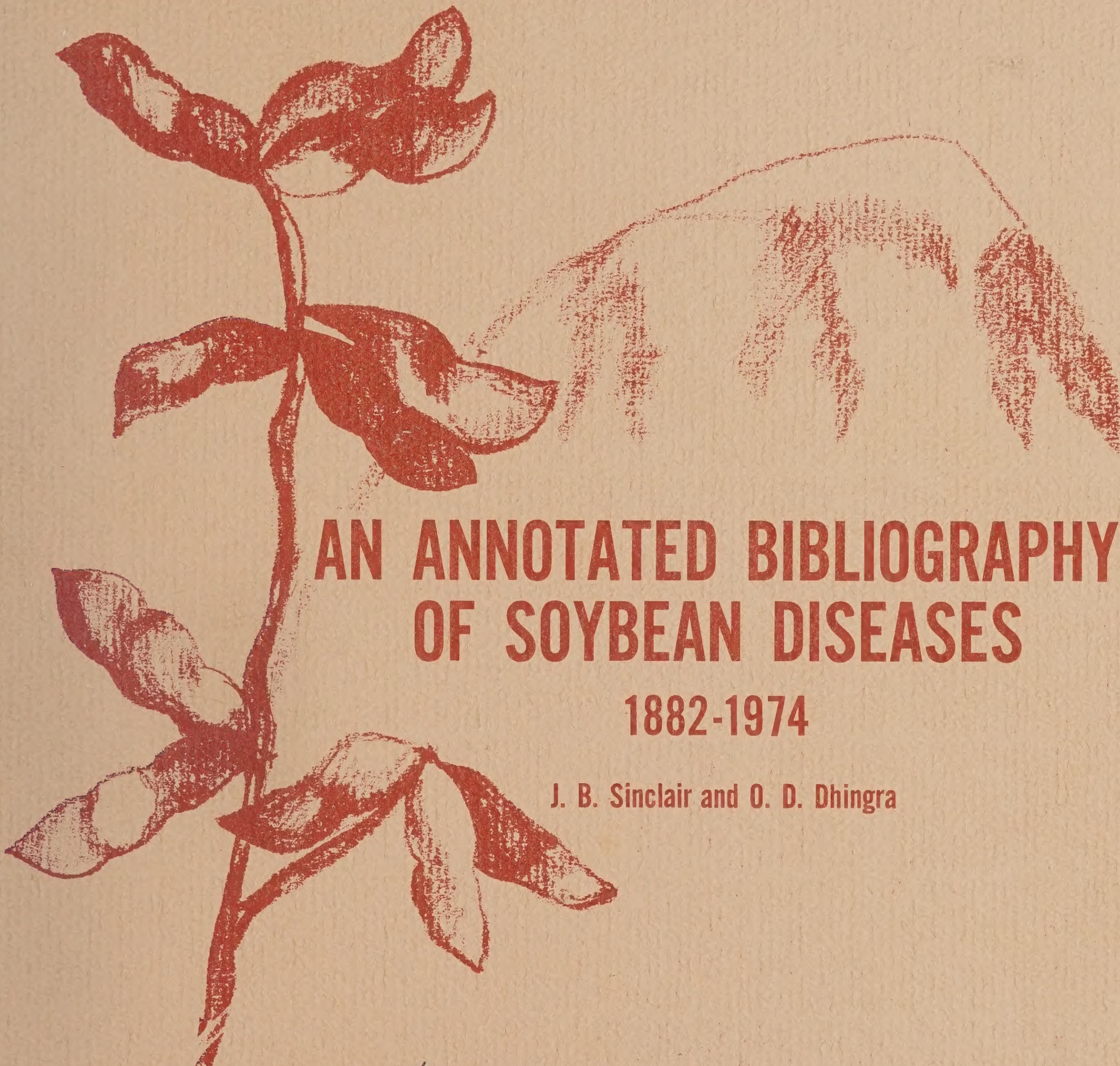

AN ANNOTATED BIBLIOGRAPHY OF SOYBEAN DISEASES

1882-1974

J. B. Sinclair and O. D. Dhingra

International Soybean Program
INTSOY

International Agricultural Publications

INTSOY Series Number 7

COLLEGE OF AGRICULTURE / UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

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FOREWORD

The International Soybean Program (INTSOY) is a cooperative program of the University of Illinois at Urbana-Champaign and the University of Puerto Rico, Mayaguez Campus, cooperating with international and national organizations to expand the use of soybeans for human food. INTSOY is primarily oriented to improve soybean production and utilization in the developing nations of the tropics and subtropics where protein-calorie deficiencies are the most serious.

One of the goals of the INTSOY program is the development and maintenance of information systems to serve soybean research workers and educators (formal and nonformal) in tropical and subtropical areas, as well as organizations and individuals in the United States and those in the international agricultural development network with interests in soybeans. To accomplish this objective, INTSOY and cooperating agencies are collecting the world literature in a number of subject-matter areas.

The publishing of this bibliography marks the first time that the world literature on soybean diseases has been brought together and annotated in a single volume. The detailed index will assist research workers and educators interested in diseases affecting soybeans in locating pertinent publications. We hope that this compilation will bring perspective to the work that has been done and insight into the development of future projects. This bibliography also will assist in identifying persons who have studied and published in specific areas of soybean disease research and reporting.

INTSOY expresses its appreciation to persons recognized in the authors' preface for their assistance and contribution to this volume.

W. N. THOMPSON
Director
International Soybean Program (INTSOY)

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PREFACE

This bibliography was begun in 1968 to provide a working file of the literature concerned with soybean [*Glycine max* (L.) Merr.] diseases. The number of references quickly grew beyond the expectations of the authors. During this period a great deal of interest in the soybean as a potential source of protein developed around the world. It became apparent that we had a unique collection that would be of use to workers dealing with soybeans in many countries. Therefore, the primary function of this bibliography is to make the soybean disease literature available to agriculture workers throughout the world and in countries where such reference material is difficult to obtain.

The annotations, wherever possible, use the authors' original abstracts or summaries with some editing for consistency of style and to reduce the length where indicated. The style manuals consulted were: *A Manual of Style* (12th ed.), University of Chicago Press, Chicago, Ill., 1969, and *CBE Style Manual* (3rd ed.), American Institute of Biological Sciences, Washington, D.C., 1972. Where papers or publications, such as host range studies, do not deal directly with soybeans, only the portion relating to soybeans is presented. Abstracts of papers not directly available, particularly those in languages other than English, are taken from *Biological Abstracts* or *Review of Plant Pathology (Review of Applied Mycology)*. Papers printed in a language other than English are indicated by brackets enclosing either the title of the paper or the name of the language used.

Previously published bibliographies dealing with soybean diseases that have been incorporated into this one are:

Chamberlain, D. W., and B. R. Lipscomb. 1967. Bibliography of soybean diseases. USDA-ARS, CR-50-67, Beltsville, Md. 98 pp.

Edwards, D. I., and J. M. Epps. 1975. Annotated bibliography of nematodes of soybeans, 1969–1973. USDA-ARS, ARS-NC-24, Beltsville, Md. 16 pp.

Epps, J. M., D. I. Edwards, J. M. Good, and R. V. Rebois. 1973. Annotated bibliography of nematodes of soybean, 1882–1968. USDA-ARS, ARS-S-8, Beltsville, Md. 75 pp.

Kreitlow, K. W., H. C. Boyd, D. W. Chamberlain, and J. M. Dunleavy. 1957. A bibliography of viruses infecting the soybean [*Glycine max* (L.) Merr.]. Plant Dis. Reptr. 41: 579–588.

Ling, L. 1951. Bibliography of soybean diseases. Plant Dis. Reptr. Suppl. 204:111–173.

The search of the literature ended with the December 1974 issues of *Biological Abstracts, Journal of Nematology, Mycopathologia et Mycologia Applicata, Nematologica, Phytopathologische Zeitschrift, Phytopathology, Plant Disease Reporter,* and *Virology,* and the December 1973 issues of *Annals of Japanese Society of Phytopathology, Indian Phytopathology,* and *Phytopathologia Mediterranea.* Bulletins, circulars, or reports such as those issued by the Agricultural Extension Service have not been included.

Citations are arranged numerically in alphabetical order according to the senior author's last name. Where an author's name appears more than once as sole or senior author, the titles are arranged chronologically without consideration of names of co-authors.

The index is divided into six major sections according to the causal agent of disease: fungi, bacteria, nematodes, viruses, nonparasitic diseases and other *Glycine* species, and seedborne microorganisms and viruses. The major diseases are subdivided according to (1) occurrence (geographically); (2) symptoms; (3) morphology, nomenclature, and physiology of the causal agents; (4) epidemiology (temperature, moisture, transmission, host range, survival, and so on); (5) pathogenesis (histopathology, toxins, enzymes, and so on); (6) resistant cultivars; (7) resistance (inheritance and mechanism of); (8) control other than resistance. Seedborne organisms are listed alphabetically. Also in the index, fungicides used either in seed treatment or as sprays, and nematicides and antibiotics are listed by name.

This bibliography includes more than 2,250 citations dating from 1882 through 1974. In a publication of this nature, omissions and some inaccuracies are inevitable and therefore a number of references related to soybean disease may have been unobtainable or overlooked. We shall appreciate having such omissions brought to our attention.

We are grateful to the United States Agency for International Development and to the International Soybean Program (INTSOY) of the University of Illinois, College of Agriculture, for providing financial support for this project. We thank the following for their assistance in the literature search and for helpful suggestions and advice: D. I. Edwards, R. M. Goodman, and R. L. Malek. We are grateful to the staffs of the Department of Plant Pathology and the University of Illinois Agricultural Experiment Station for their patience and support of the project. We particularly thank R. E. Ford, Head of the Department of Plant Pathology, and W. N. Thompson, Director of INTSOY, for their encouragement and moral support during the compilation of the bibliography. We give special thanks to Vicki Drollinger Toews, who typed the manuscript, and to Maralyn Chew, Arleah Dix, and Sheila Welch, who helped in the preparation of the manuscript. The entire manuscript was edited by Lorena Neumann.

AN ANNOTATED BIBLIOGRAPHY OF SOYBEAN DISEASES

1. ABE, T., and M. KONO. 1953. Studies on the white root-rot of the tea bush. I. Saiko Univ. Fac. Agr. (Kyoto, Japan) Sci. Rpt. 5, pp. 93–105.

Three cultural strains of *Rosellinia* (two from tea and one from ramie) inoculated into soil inhibited germination of soybean seeds to about 45%. From microscopic observations of cross sections of infected seed, the seeds were thought to be killed by substances secreted from the fungus hyphae.

2. ABO-EL-DAHAB, M. K. 1969. Occurrence of brown stem rot disease of soybeans in Egypt (U.A.R.). Phytopath. Medit. 7:28–33.

The disease caused by *Cephalosporium gregatum* is reported for the first time from Egypt. The fungus is isolated from seeds produced on infected plants. Fungal conidia were produced in xylem vessels. Cultural characteristics and morphology of the fungus are described. Conidia germinated in distilled water at 15–30 C with optimum 25 C. In the host the fungus was present in vascular elements, particularly in protoxylem elements and parenchyma tissues of pith. Excessive tylosis production in the host was noted.

3. ABRAMOFF, I. N. 1931. [Fungal diseases of soybean in the Far East.] *In* Diseases and pests of soybean in the Far East [in Russian], pp. 3–84. Far Eastern Sta. Plant Prot., Vladivostok.

An account chiefly on symptoms and morphology of causal organisms of 11 diseases hitherto recorded in Russian Far East. Cultivars with yellow or green seeds are susceptible to downy mildew (*Peronospora manshurica*), while those with black and brown seeds are practically immune. Sanitation and rotation are recommended for control of *Sclerotinia libertiana* (= *Whetzelinia sclerotiorum*). *Mycosphaerella phaseolicola* may be the perithecial stage of *Cercospora daizu* (= *C. sojina*). Other diseases include: seedling blight caused by *Fusarium* sp., leaf spot caused by *Isariopsis griseola*, and gray mold caused by *Hypochnus centrifugus*. *Septoria glycines* leaf spot and *Phyllosticta sojaecola* in association with a perfect-stage *Pleosphaerulina sojaecola* caused an olive-colored leaf spot.

4. ACIMOVIC, M. 1963. *Sclerotium bataticola* Taub. as a parasite on soybean in Yugoslavia [in Croatian, English summary]. Savremena Poljoprivreda 11:271–280.

First report of this disease on soybeans for Yugoslavia. Often more than 50% of the plants are affected. Early planting and early maturing resulted in the greatest infection. Most rapid mycelial growth was on potato-dextrose agar and on agar with onion and oats, and likewise the most rapid production of sclerotia. Optimum temperature for development was 30 C, minimum 10–15 C, and maximum 35–40 C. Sclerotia were smallest at 30 C and largest at 15 and 35 C.

5. ACIMOVIC, M. 1963. The response of an assortment of soybeans to the occurrence of wilting caused by *Sclerotium bataticola* Taub [in Croatian, English summary]. Savremena Poljoprivreda 11:899–904.

A survey in Voivodina (northeastern Yugoslavia) of 141 cultivars for natural infection showed 30 to be completely immune, 50 highly resistant, and 61 highly susceptible.

6. ACIMOVIC, M. 1964. The occurrence of *Macrophomina phaseoli* on some agricultural crops and morphological and ecological properties of the parasite [in Croatian, English summary]. Savremena Poljoprivreda 12:55–66.

In Yugoslavia, *M. phaseoli* (= *M. phaseolina*) occurred on soybean, causing 50% losses in stand. Use of late cultivars and late planting reduced stand losses. *M. phaseolina* was frequently associated with *Fusarium* sp.

7. ADAM, D. B., and A. T. PUGSLEY. 1935. A yellow bacterium associated with "halo" blight of beans. Australian J. Expt. Biol. and Med. Sci. 13:157–164.

Phytomonas (= *Pseudomonas*) *medicaginis phaseolicola* occurred occasionally on soybean in Victoria.

8. ADAMS, J. F. 1923. Plant diseases and their prevalence for 1922 in Delaware. Delaware Sch. Agr. Stencil Circ. 1.

Records the occurrence of a leaf spot probably caused by *Bacillus lathyri* and of a nonparasitic chlorosis or yellow leaf which was associated with food requirements, especially deficiency of potash.

9. ADAMS, J. F. 1925. Department of plant pathology. Annual Report Delaware Agr. Expt. Sta. for the fiscal year ending 30 June 1924.

Records the occurrence of *Bacterium* (= *Xanthomonas*) *phaseoli sojense*.

10. ADAMS, J. F. 1926. Department of plant pathology. Annual Report Delaware Agr. Expt. Sta. for the fiscal year ending 30 June 1926. Delaware Agr. Expt. Sta. Bull. 147, pp. 33–34.

Septoria glycines caused a severe defoliation of soybean.

11. ADAMS, J. F. 1933. Report of the plant pathologist for 1932. Delaware State Board Agr. Quart. Bull. 23, pp. 3–16.

Records the occurrence of *Cercospora daizu* (= *C. sojina*).

12. ADAIR, C. R., C. R. MC CLELLAND, and E. M. CRALLEY. 1950. Soybean research in Arkansas, 1936–48. Varietal tests for seed and hay and studies in disease control. Arkansas Agr. Expt. Sta. Bull. 490, p. 62.

Seed treatment of soybean from 1934–1947 with arasan, arasan S.F., spergon, or new improved cerasan increased

stands at early, medium, and late planting dates but gave no significant increases in yield. There was no increase in yield when treated seed was sown at the rate of 50 lb./acre. With high-quality seed a lighter sowing might be adopted if the seed is treated.

Seed treatment is recommended when poor-quality seed with low germinability is planted. Seed treatment with arasan or spergon was found to be compatible with seed inoculation for land previously planted with soybean. Seed treatment is not recommended when soybeans are planted on land for first time. The principal controls for *Xanthomonas phaseoli* var. *sojense, Pseudomonas glycinea, P. tabacum* (= *P. tabaci*), *Cercospora sojina,* and *Septoria glycines* are crop rotation and planting resistant cultivars. Cultivars Ogden, Dortchsoy 2, Palmetto, CNS, Cherokee, and Louisiana Green are resistant to bacterial leaf diseases.

13. AFANASIEV, M. M., and H. E. MORRIS. 1952. Bean virus 2 (yellow) on Great Northern bean in Montana. Phytopathology 42:101–104.

Soybeans were infected when inoculated with plant juice of infected beans.

14. AGARWAL, D. K. 1973. Pathological and physiological studies of some root infecting fungi. Ph.D. Thesis. Agra University, Agra, India.

Seventeen fungi were isolated from soybean plants, of which *Fusarium oxysporum, F. solani, F. graminearum,* and *F. equiseti* were new records for India. *Nectria haematococa,* the perfect stage of *F. solani,* is also reported as a new record from India. The four species of *Fusarium* had optimum and minimum temperatures for growth at 30 and 15 C, with 28 C optimum for sporulation. Studies were also done on *Macrophomina phaseolina* including fungicidal control.

15. AGARWAL, D. K., S. GANGOPADHYAY, and A. K. SARBHOY. 1973. Effect of temperature on charcoal rot disease of soybean. Indian Phytopath. 26:587–598.

The optimum temperature for growth of various isolates of *M. phaseoli* (= *M. phaseolina*) was 30–38 C. On all 15 cultivars tested, maximum disease occurred at temperatures ranging from 35–40 C. Temperatures above 45 C reduced disease incidence.

16. AGARWAL, S. C., and S. R. KOTASTHANE. 1971. Resistance in some soybean varieties against *Sclerotium rolfsii* Sacc. Indian Phytopath. 24:401–403.

Of 25 cultivars tested, the following grouping is made: Resistant (0–10% seedling mortality) — IC 216, Taichung E 32, Improved Pelican, Monetta, Shelby, Pb 1, Palmetto, Hood, and Jackson. Moderately resistant (11–30% sm) — Hill, Scott, Dare, Bienville, Pickett, Clark 63, Semmes, Harosoy, Shih Shih, Lee, Dorman, and Hardee. Moderately susceptible (31–70% sm) — Bragg, Kent, Hampton, Davis. Susceptible (71–100% sm) — none.

17. AGARWAL, V. K., and A. B. JOSHI. 1971. A preliminary note on the purple stain disease of soybean. Indian Phytopath. 24:811–814.

Purple stain caused by *Cercospora kikuchii* has been observed to a great extent in some of the commercial cultivars of soybean grown in Nainital Tarai of Uttar Pradesh. There is a purple discoloration of the seed coat and this discoloration is sharply visible after threshing of the crop. There may be complete discoloration of the seed coat or it may be restricted to a small portion of the seed. In severe cases this purple color has also been observed on the cotyledons after removing the seed coat. This is the first report of the purple stain disease of soybean from India. Preliminary experiments were therefore carried out to supply information on the influence on quality, emergence, and spread of the pathogen through the infected seed under conditions prevailing in Nainital Tarai.

18. AGARWAL, V. K., S. B. MATHUR, and P. NEERGAARD. 1972. Some aspects of seed health testing with respect to seed-borne fungi of rice, wheat, blackgram, greengram, and soybean grown in India. Indian Phytopath. 25:91–100.

Seeds of rice, wheat, blackgram, greengram, and soybean, when tested for seedborne fungi by the blotter and agar plate methods, were found to be associated with a range of fungi including some pathogens known to cause diseases of economic importance. The blotter method proved better than the agar plate method for most of the fungi. The three incubation conditions (20 C NUB, 28 C NUV, and 28 C DL) proved equally effective. Pretreatment with NaClO (2% available chlorine) in the agar plate method reduced the percentage of incidence of some pathogens. Thiram and captan as seed treatment did not control the fungi completely but reduced seedborne fungi sufficiently. Thiram not only is fungicidal in action but acts as a fungistatic agent against some pathogens. Fungi isolated from soybean seeds were: *Alternaria longissima, Colletotrichum truncatum, Curvularia lunata, Drechslera tetramera, Epicoccum purpurascens, Fusarium equiseti, F. moniliforme, F. solani, Macrophomina phaseoli, Nigrospora oryzae, Phoma* spp., *Phomopsis* sp., and *Verticillium cinnabarinum.*

19. AGARWAL, V. K., O. V. SINGH, P. N. THAPLIYAL, and R. K. MALHOTRA. 1973. Soybean (*Glycine max*), purple stain (*Cercospora kikuchii*). Amer. Phytopath. Soc. Fungicide and Nematicide Tests, Results of 1972. 28:100.

An experiment was conducted during the last two kharif seasons (1970–1971) to determine the chemical for con-

trol of purple stain disease of soybean. Seven different chemicals — aureofungin, benomyl, cuman, carboxin, dithane M-45, fytolan, and ziram — were used as sprays. During 1970 kharif the crop was treated with five sprays each of aureofungin (20 ppm), benomyl (0.05%), cuman (0.25%), and dithane M-45 (0.25%). First spraying was at preflowering stage and others at intervals of 10 days. The experiment was repeated during 1971 kharif with benomyl (0.05%), carboxin (0.1%), dithane M-45 (0.25%), fytolan (0.12%), and ziram (0.25%). Only two sprays, the first at preflowering stage (25 days after planting) and the second 1 month after first spray (during flowering stage), were applied. The change in treatments during 1971 kharif was based on preceding year's results. Seeds obtained after harvest were evaluated on the basis of purple discoloration of seed coat. The blotter method recommended by the International Seed Testing Association also was employed to determine the presence of *Cercospora kikuchii* in apparently healthy seeds.

The data indicated that the disease was best controlled by benomyl (0.05%), which reduced the incidence by about 90%. During kharif 1970 five sprays were applied but in 1971 kharif only two sprays were applied. Almost the same level of disease control was obtained during both years, indicating that two well-timed sprays (before flowering and 1 month later) of benomyl 0.05% were as effective in disease control as five (10-day interval) sprays. Apparently each benomyl spray gave protection for at least 30 days. This longer persistence of benomyl and/or its decomposition product also may account for the efficacy of this compound over other nonsystemics tried.

20. AHMAD, M., and R. F. HARWOOD. 1973. Studies on a white fly-transmitted yellow mosaic of urd bean (*Phaseolus mungo*). Plant Dis. Reptr. 57:800–802.

Yellow mosaic (YM) of urd bean has characteristics of a viral disease, but transmission experiments did not preclude a pathogen with similar characteristics. No transmission occurred by mechanical means or by dodder (*Cuscuta*), but grafting and white fly (*Bemisia tabaci*) from infected mung fields yielded symptoms; no transovarian carryover of pathogen by white flies was demonstrated. The same pathogen also affects mung bean (*Phaseolus aureus*), moth bean (*P. aconitifolius*), and soybean. Partial resistance to YM was found in urd bean lines that could be incorporated into susceptible cultivars with otherwise desirable characteristics.

21. AHN, J. K., and B. K. CHUNG. 1970. Effects of seed disinfectants for controlling the soybean anthracnose [in Korean, English summary]. J. Plant Prot. (Korea) 9:21–24.

Effect of seed disinfectants for controlling the soybean anthracnose was investigated with percentage of seedling infection to seed or soil and with inhibition zone on potato-dextrose agar. Chemicals tested were as follows: arasan, orthocide, phygon-XL, P.T.A.B., and mercuron. In seed inoculation, all the chemicals resulted in significantly less seedling infection than was obtained in control. In regard to soil infection, the result was similar but percentages of infection were lower than in the seed inoculation. Percentages of seedling infection were not necessarily correlated to the inhibition zones on potato-dextrose agar by the same chemicals.

22. AIST, S., and R. D. RIGGS. 1967. Amino acids from *Heterodera glycines* larvae. Phytopathology 57:801. (Abstr.)

The susceptibility or resistance of a host to a parasite is determined by a number of factors. Among these are the chemicals discharged by the parasite. As part of a study on the chemistry of resistance in soybean to soybean-cyst nematodes, amino acids discharged by second-stage larvae of *Heterodera glycines* were compared to those extracted from within the nematodes. Surface-sterilized larvae were incubated in sterile, deionized water for 56 hr. at 27 C and subsequently homogenized. Amino acids were isolated from the incubation solution and from the homogenates and separated by two-dimensional paper chromatography. Aspartic acid, glutamic acid, serine, glycine, and alanine, plus two nonidentified ninhydrin-positive spots, were obtained from the incubation solution. The homogenate yielded aspartic acid, glutamic acid, serine, glycine, alanine, threonine, and glutamine, plus six other spots tentatively identified as lysine or ornithine, asparagine, tyrosine, methionine or valine, phenylalanine, leucine or isoleucine.

23. AIST, S., and R. D. RIGGS. 1969. Amino acids from *Heterodera glycines*. J. Nematol. 1:254–259.

Amino acids emitted and extracted from surface-sterilized larvae and adults of *Heterodera glycines* were identified by paper chromatography and quantitatively analyzed by column chromatography. Five amino acids (alanine, aspartic acid, glutamic acid, glycine, and serine) were emitted by *H. glycines* larvae and eight (asparagine, glutamine, leucine/isoleucine, lysine, methionine sulfoxide, threonine, tyrosine, valine/methionine) were found in extracts from crushed larvae. In addition to the amino acids emitted or extracted from larvae, four others were emitted by adults (γ-aminobutyric acid, histidine, phenylalanine, and proline). Four different amino acids (arginine, cystathionine, hydroxyproline, and ornithine) were found only in the extract from crushed adults. Greater quantities of alanine, aspartic acid, and glycine were emitted than could be detected in nematode extracts, suggesting selective emission. Subsamples of nematode populations were taken from growing plants 19, 26, 33, and 40 days after inoculation and extracted to determine whether changes in specific amino acid

content correlated with aging. Proline content shifted most, increasing from 4.1% to 21.5% of the total amino acid complement from the nineteenth to the fortieth day.

24. AITKEN, Y., and B. J. GRIEVE. 1943. A mosaic virus of subterranean clover. J. Australian Inst. Agr. Sci. 9:81–82.

The mosaic virus of *Trifolium subterraneum* can infect soybean by artificial inoculation.

25. AKHATOVA, F. K. 1969. Soybean mosaic [in Russian]. Vest. Sel. Khoz. Nauk Alma-Aea. 12(5):79–82.

The virus usually transmitted by *Myzus persicae* attacked 20–60% of soybean plants, reducing yields by 35.9–48.3%. The most resistant cultivars are Vysokostebelnaya 2, and Lincoln. Use of healthy seed and pest control are recommended.

26. AKHATOVA, F. K. 1972. The physiological properties of soybean mosaic virus and its effects on the biochemical qualities of plants [in Russian]. Izvestiya Akademii Nauk Kazakhskoi SSR, Biologicheskaya 10:70–74.

The virus, causing widespread infection in the Alma-Aea region, remained viable in vitro for 5 days, with thermal death point 55 C, DEP 10^4. The protein content in green tissues of infected plants was reduced by 6.44% and in seeds 4.31%.

27. ALBRECHT, H. R. 1939. Soybean virus disease studies. Alabama Agr. Expt. Sta. 50th Ann. Rpt. 19 pp.

All cultivars grown in the area are susceptible to virus diseases.

28. ALBRECHT, W. A., and H. JENNY. 1931. Available soil calcium in relation to "damping off" of soybean seedlings. Bot. Gaz. 92:263–278.

Damping-off is decreased as the availability of Ca increases, while H-ion concentration is of minor importance in relation to it. Ca ion is superior to other mono- or divalent ions at equal concentrations. Free, diffusible Ca ion is more effective than absorbed, exchangeable ions.

29. ALLESCHER, A. 1901. Fungi imperfecti. *In* G. L. Rabenhorst, Kryptogamen-flora von Deutschland, Oesterreich und der Schweiz. Aufl. 2, Bd. 1, Abt. 6. 1066 pp.

Includes a description of *Septoria sojina*.

30. ALLINGTON, W. B. 1944. Soybean disease investigations at the U.S. Regional Soybean Laboratory. Soybean Dig. 4(11):60, 65.

As a result of nursery inspection in 24 states, the following diseases were considered to be of importance: bud blight, bacterial pustule, bacterial blight, wildfire, sclerotial blight (confined to the South), pod and stem blight, and downy mildew. Popular articles, stressing the use of resistant cultivars. Seed treatment increased stand but yield remained unaffected.

31. ALLINGTON, W. B., G. C. KENT, I. W. TERVET, and B. KOEHLER. 1945. Results of the uniform soybean seed treatment tests in 1944. Plant Dis. Reptr. Suppl. 159:220–224.

Results of tests with semesan, new improved ceresan, arasan, and spergon at 18 locations in the United States indicate that significant increases in stand were obtained only occasionally and yield was generally unaffected.

32. ALLINGTON, W. B. 1945. Wildfire disease of soybean. Phytopathology 35:857–869.

Tobacco wildfire caused by *Pseudomonas tabaci* was prevalent on soybean. The morphological, physiological, serological, and pathological characters of the isolates of the organism from soybean and tobacco are identical. Necrotic spots on leaves are variable in size and always surrounded by a wide, yellow halo. In damp weather the lesions enlarge and coalesce; defoliation starts from the lower part of the plant. Water-soaking of the leaf tissues (caused by beating rain) greatly enhances penetration and further spread.

33. ALLINGTON, W. B. 1946. Soybean diseases in the Corn Belt in 1945. Soybean Dig. 6(11):48.

A popular article, briefly describing symptoms, control, and losses caused by brown stem rot, bacterial blight, pustules, and bud blight.

34. ALLINGTON, W. B. 1946. Bud blight of soybean caused by the tobacco ring spot virus. Phytopathology 36:319–322.

The effect of tobacco ring spot virus on soybean plants depends largely upon plant age at time of infection. Symptoms consist of characteristic curving of terminal bud. The young expanding leaves are bronzed and leaves sometimes drop. Eventually the growing point becomes necrotic and brittle. Thermal inactivation point of the virus is 65 C. The virus also affects the seeds.

35. ALLINGTON, W. B. 1946. Brown stem rot of soybean caused by an unidentified fungus. Phytopathology 36:394. (Abstr.)

This disease appeared in a few fields in central Illinois in fall 1944, and in 1945 it occurred in severe epidemic form in central Indiana, Illinois, and Iowa. The damage in central Illinois was extensive, reaching 10% in some counties. Complete loss occurred in some fields. Symptoms consist of browning of the pith and xylem of the stem, starting at or below soil level and progressing slowly upward with only slight external symptoms in the form of occasional blighting of lower leaves. With unusual rapidity the leaves in the tops of the plants develop an interveinal chlorosis that is rather quickly followed by

necrosis. In advanced stages the outside of the stem appears brown and the plants lodge badly because of extensive internal rotting. Temperatures must be low for disease development. The fungus appears to be soilborne and generally present in the Midwest. The dense, putty-colored, nonfruiting mycelium grows slowly on all media tested. Isolation and artificial inoculation are readily made by standard methods. A few fields have indicated that continuous cropping to soybeans may increase the disease damage.

36. ALLINGTON, W. B., and C. V. FEASTER. 1946. The relation of stomatal behavior at the time of inoculation to the severity of infection of soybean by *Xanthomonas phaseoli* var. *sojense* (Hedges) Starr and Burk. Phytopathology 36:385–386.

Inoculation done between 8 a.m. and 2 p.m. gives greatest amount of infection. The infection occurs when stomata are open. Cultivars that appear to be resistant when inoculated at midday may prove susceptible.

37. ALLINGTON, W. B., and D. W. CHAMBERLAIN. 1948. Brown stem rot of soybean. Phytopathology 38:793–802.

The causal fungus is named *Cephalosporium gregatum* n.sp. and its morphology and cultural characteristics are described. The best medium for sporulation was soybean stem agar, on which conidia appeared after 5 days at 20 C. The minimum, optimum, and maximum temperatures for mycelial growth were below 8 C, 22–24 C, and above 30 C; for conidia germination, 15 C, 21–25 C, and 30 C respectively; for sporulation, 15–20 C and 28 C. Air temperatures below 21 C were essential for rapid development of the disease. The pathogen enters readily through unwounded stem at base. Main and lateral roots are most common points of entry. The fungus is present in vessels of main root prior to stem invasion. The amount of mycelium in vessels varies from a few strands to a solid mass. The hyphae are occasionally found in pith. The fungus could not be recovered from stems of diseased plants stored for 3 months in greenhouses. Crop rotation reduced disease incidence. Symptoms are described.

38. ALLINGTON, W. B., and D. W. CHAMBERLAIN. 1949. Trends in the population of pathogenic bacteria within leaf tissues of susceptible and immune plant species. Phytopathology 39:656–660.

The multiplication of *Xanthomonas phaseoli* and *Pseudomonas glycinea* within leaves of bean and soybean was initiated about equally in both immune and susceptible hosts. After a time the inhibitory effect of the noncongenial host became apparent and the bacterial population increased less rapidly or decreased markedly. The population within the congenial host continued to increase until destruction of the tissues occurred.

39. ALLINGTON, W. B., E. L. MOORHEAD, and R. STAPLES. 1960. Alfalfa mosaic virus in soybean. Phytopathology 50:627. (Abstr.)

Soybeans near alfalfa fields have been found to be infected sporadically with alfalfa mosaic virus. Alfalfa fields in eastern Nebraska commonly have up to 20% infection without apparent symptoms. Large populations of the pea aphid, *Macrosiphum pisi,* often occur in the spring on alfalfa and are blown by wind, thereby carrying the virus to adjoining soybean fields. Soybean is not a satisfactory host for this insect, which leaves the plant after feeding only briefly. Unusual distribution of the disease occurs in soybean fields. The strain of virus commonly found in eastern Nebraska produces extreme chlorosis of soybeans, sometimes similar in gross aspects to the symptoms of Fe or Mn deficiency. Greenhouse experiments revealed the usual wide host range for alfalfa mosaic. The virus from infected soybean is readily purified by the chloroform-butanol method of Steere, followed by density-gradient centrifugation. Electron microscopy confirmed that the virus is a small sphere or an extremely short rod. Intramuscular injection of rabbits with the virus in Freund adjuvant and utilization of booster doses produced immune sera of satisfactory titer used to verify identification.

40. ALLISON, J. L. 1947. Present status of soybean diseases. Soybean Dig. 7(11):49.

Outlines the organization and scope of the project for soybean disease research started in 1945 by the U.S. Bureau of Plant Industry and U.S. Department of Agriculture.

41. AMMON, V. D., T. D. WYLLIE, and M. F. BROWN. 1971. Ultrastructure determination of infection process of *Macrophomina phaseoli* in *Glycine max*. Phytopathology 61:883. (Abstr.)

Root systems of plants grown in pots were exposed to the charcoal rot fungus by injecting into the rhizosphere 50 ml of an actively growing shake culture. After incubating 1–10 days, selected roots were fixed and embedded in paraffin and plastic in preparation for light and electron microscope examination. Roots of all cultivars of soybean seedlings tested became infected within ca. 3 days as determined by direct observation. Fungal invasion of root tissue occurred intercellularly and intracellularly. Penetration of soybean root tissue was accompanied by changes in organization of the cytoplasm; disruption of cellular and tissue integrity is believed to occur by the production of pectolytic enzymes in association with mechanical pressure.

42. AMMON, V. D., and T. D. WYLLIE. 1972. Penetration and host-parasite relationships of *Macrophomina phaseolina* on *Glycine max*. Phytopathology 62:743–744 (Abstr.)

Primary roots of Adelphia soybean seedlings were surface-inoculated with 17-day-old sclerotia of *Macrophomina phaseolina*. Samples were collected after 1, 2, and 3 days' incubation and prepared for scanning electron microscope (EM) examination. Scanning micrographs revealed that hyphal strands radiated in all directions from the germinating sclerotia without any recognizable pattern of growth over the root surface. Contact with the root by the tips of primary and secondary hyphal strands resulted in development of flask-shaped appressoria. Light and EM micrographs of sections from other infected samples indicated that penetration of root surfaces occurred most frequently between epidermal cells, aided by chemical softening and mechanical pressure. Growth of the pathogen through cortical tissue and into the stele occurred within 3 days. Initial growth of *M. phaseolina* through root tissue was primarily confined to intercellular spaces and the middle lamella, with intracellular colonization occurring later. Deterioration of the middle lamella, presumably by the action of fungal-secreted pectolytic enzymes, accompanied by intercellular growth and recognizable organelles in root cells containing the fungus, were commonly observed.

43. AMMON, V. D., T. D. WYLLIE, and M. F. BROWN, JR. 1974. An ultrastructure investigation of pathological alterations induced by *Macrophomina phaseolina* (Tassi) Goid. in seedlings of soybean, *Glycine max* (L.) Merr. Phys. Plant Path. 4:1–4.

An ultrastructural investigation of seedling soybean root tissue infected by the charcoal rot fungus indicated that, during initial stages of pathogenesis, the fungus appears to be restricted mostly to the intercellular spaces, and penetration of interior cell walls occurred as a result of both mechanical pressure and chemical softening. Subsequently, the middle lamella disintegrates, the plasmalemma is separated from the cell wall, the cytoplasm becomes highly vesiculated and the mitochondria disorganized. In later stages of pathogenesis, the fungus becomes intracellular and recognizable cytoplasmic organelles disappear.

44. ANAHOSUR, K. H., K. FAZALNOOR, and B. C. NARAYANASWAMY. 1971. A new leaf spot of *Salvia leucantha* from India. Sydowia 25:143–146.

Corynespora cassicola isolated from diseased plants was pathogenic to soybean.

45. ANAHOSUR, K. H., and K. FAZALNOOR. 1972. Studies on foliicolar fungi of soybean crop. Indian Phytopath. 25:504–508.

Leptosphaerulina trifolii is described as new species causing leaf spot in India. Ascostroma uniloculate, ostiolate, dark brown, spherical to globose, 120–168 μ in diameter. Asci obclavate to obovate, truncate base, 4–6 in each locule, nonparaphysate 64–80 $\times$ 36–42 μ. Ascospore clavate to spindle-shaped, hyaline, biseriated, muriform 3-septate, 24–32 $\times$ 8–10 μ. Leaf spots appear on both surfaces. Initially, spots are circular with gray center but become irregular and dull white or gray. *Stemphylium botryosum* (n. sp.) causes leaf blight. Initially, small, circular spots with dark-brown margin and gray center appear, enlarging to form large patches. The leaves dry up and plants defoliate. The mycelium of causal fungus is septate, subhyaline; conidiophores olivaceous, brown to dark brown, septate, broad, and produce single conidium at the tip. Conidia ovoid to ellipsoid, muriform, 3-transverse and 1–2 longitudinal septate dark brown 24–28 $\times$ 11–12 μ. *Periconia byssoides* also caused leaf blight.

46. ANCALMO, O. 1959. A preliminary list of parasitic diseases of plants of El Salvador [in Spanish]. Serv. Coop. Agr. Salvadoreno Amer., Bol. Tec. 22. 29 pp.

Powdery mildew and other diseases are listed for several genera of legumes, including soybeans, without listing specific hosts.

47. ANDREWS, E. A. 1950. Brief notes on plant diseases. Stem blight of soybeans in Michigan. Plant Dis. Reptr. 34:214.

Diaporthe phaseolorum var. *batatatis* caused stem blight (= stem canker) of soybean. Stems were exposed to the weather during the winter and clusters of perithecia and ascospores developed but no pycnidia or conidia.

48. ANDREWS, F. W. 1947. The parasitism of *Striga hermonthica* Benth. on leguminous plants. Ann. Appl. Biol. 34:267–275.

Experiments were made to find what leguminous plants were suitable for cleaning *Striga*-infested soils. Soybean plants of black-seeded cultivars have the ability to germinate *Striga* seeds. Some *Striga* plants were attached to the soybean roots. The yield was not affected but it appears that the soybean plant interposes a definite resistance to penetration by haustoria of the parasite.

49. ANONYMOUS. 1913. Plant diseases observed in Italy during 1911 and 1912 [in German]. Zeitschr. für Pflanzenkrank. 23:201–205.

Observed *Phyllosticta sojaecola* and *Septoria sojina* (= *S. glycines*) in Italy.

50. ANONYMOUS. 1922. Investigations on chlorosis of soybeans [in Japanese]. J. Plant Prot. (Tokyo) 9:101–105.

The history of chlorosis was traced to Frank in 1881. The causal organism was identified as *Heterodera schachtii*. Susceptibility of Japanese cultivars was recorded. The disease was especially prevalent (1) when soybeans were rotated with other susceptible crops; (2) on soils with inadequate fertilizers; and (3) on dry, sandy soils with poor water-holding capacity.

51. ANONYMOUS. 1923. Thirty-fifth annual report of the Kentucky Agr. Expt. Sta. for the year 1922. 611 pp.

Soybean mosaic virus was not transmissible to tobacco.

52. ANONYMOUS. 1928. Reports received from experimental stations 1926–1927. Empire Cotton Growing Corporation, London. 251 pp.

In Natal, South Africa, soybeans succumbed completely to a Fusarium wilt and were affected by a bacterial disease, probably caused by *Bacterium glycineum* (= *Pseudomonas glycinea*).

53. ANONYMOUS. 1929. Department of botany. 42nd Ann. Rpt. Pennsylvania Agr. Expt. Sta. for the fiscal year ending 30 June 1929. Bull. 243, pp. 13–16.

Bacterium leguminosarum migrates intercellularly at initial stage after invasion of soybean leaves, but later it becomes intracellular, entering the cells through cavities in the cell walls, apparently made by dissolving-power of the bacterium. Nuclear and cellular enlargement accompanied by a multinuclear condition rapidly follows cellular invasion.

54. ANONYMOUS. 1930. Research in botany. North Carolina Agr. Expt. Sta. Ann. Rpt. 52, pp. 78–91.

None of the fungicides used to control *Cercospora daizu* (= *C. sojina*) was effective. This fungus overwinters on diseased plant refuse and may survive in the seeds for 3 years.

55. ANONYMOUS. 1932. Virus diseases of tobacco in Nyasaland. Nyasaland Dept. Agr. Bull. 2.

Soybean was infected by a disease similar to leaf curl of tobacco and supported its insect vector, white flies.

56. ANONYMOUS. 1933. Plant diseases. Facts for farmers. Ann. Rpt., Dir. Wisconsin Agr. Expt. Sta. 1931–32. Wisconsin Agr. Expt. Sta. Bull. 425, pp. 96–112.

Yellow strain of bean (*Phaseolus vulgaris*) mosaic is capable of infecting soybeans.

57. ANONYMOUS. 1933. Progress made in study of bean diseases. Wisconsin Agr. Expt. Sta. Bull. 425, pp. 101–102.

The robust or yellow strain of bean mosaic can infect soybean.

58. ANONYMOUS. 1934. Plant diseases in Denmark in 1933. Survey of data collected by the state phytopathological experiment station [in Danish]. Planteavl. 40:258–300.

Records the occurrence of *Bacterium sojae* (= *Pseudomonas glycinea*) on soybeans.

59. ANONYMOUS. 1937. Experiments on the prevention of soybean chlorosis [in Japanese]. J. Plant Prot. (Tokyo) 24:624–625.

Treating soil with formalin and chloropicrin reduced soybean chlorosis but also decreased the yield of soybeans.

60. ANONYMOUS. 1938. Root-knot nematode control by cultural practices. Georgia Coastal Plains Expt. Sta. Ann. Rpt. 1937–38. Bull. 29. 130 pp.

Rotations with cotton, corn, root-knot resistant soybeans (Laredo and Biloxi), and root-knot resistant cowpeas (Brabham and Iron) are of only slight value in decreasing root-knot in heavily infested fields.

61. ANONYMOUS. 1938. Summary of the scientific research work of the institute of plant protection for the year 1936. III. Virus and bacterial diseases of plants, the biological, the chemical, and the mechanical methods of plant protection [in Russian]. Leningrad. 111 pp.

Bacterium (= *Xanthomonas*) *phaseoli* var. *sojense* is included in a list of bacterial pathogens of soybean found in U.S.S.R.

62. ANONYMOUS. 1943. Plant diseases and pests in Denmark, 1942. Survey of data collected by the state phytopathological experiment station [in Danish, English summary]. Tidsskr. Planteavl. 48:1–90.

Peronospora manshurica was found on soybean leaves from Lolland. This is a first report from Denmark.

63. ANONYMOUS. 1943. Soya beans in South Africa. Dept. Agr. South Africa Bull. 240.

Includes a brief account of the following diseases and pathogens: bacterial blight, *Erysiphe polygoni, Peronospora trifoliorum,* anthracnose, and *Sclerotium rolfsii.*

64. ANONYMOUS. 1943. Research and farming. 66th Ann. Rpt. North Carolina Agr. Expt. Sta. 1942–43. 122 pp.

Bacterial pustule [*Xanthomonas phaseoli* var. *sojense*] causing defoliation of soybean is very prevalent and survives the winters in dead leaves and seeds. Seed treatment failed to check the disease. Cultivars Ogden, Otootan, Palmetto, and Woods Yellow were found more resistant than others.

65. ANONYMOUS. 1943. Reports on diseases of soybeans. Plant Dis. Reptr. 27:299–301.

Records the occurrence of *Xanthomonas phaseoli* var. *sojense, Pseudomonas glycinea, Peronospora manshurica, Cercospora daizu* (= *C. sojina*), *Diaporthe sojae?, Sclerotium bataticola* (= *Macrophomina phaseolina*), *S. rolfsii,* and mosaic virus.

66. ANONYMOUS. 1943. Reports on diseases of soybeans. Plant Dis. Reptr. 27:506–514.

Reports the occurrence and prevalence of following diseases and pathogens in the United States: mosaic virus, *Peronospora manshurica, Cercospora sojina, Pythium*

spp., *Rhizoctonia* sp., *Fusarium* sp., *Glomerella glycines, Sclerotium bataticola* (= *Macrophomina phaseolina*), *Diaporthe sojae* (= *D. phaseolorum* var. *sojae*), *Pseudomonas glycinea,* and *Xanthomonas phaseoli* var. *sojense.*

67. ANONYMOUS. 1944. Reports on soybean diseases. Plant Dis. Reptr. 28:752–753.

Records the occurrence and prevalence of the following pathogens on soybeans: *Pseudomonas glycinea, Xanthomonas phaseoli* var. *sojense, Peronospora manshurica,* tobacco ring spot virus, and mosaic virus.

68. ANONYMOUS. 1944. Other reports on soybean diseases. Plant Dis. Reptr. 28:959–960.

Records the occurrence and prevalence of the following pathogens on soybean: *Diaporthe phaseolorum* var. *sojae, Glomerella glycines, Cercospora* sp., *Fusarium* sp., *Alternaria* sp., *Sclerotium rolfsii, S. bataticola* (= *Macrophomina phaseolina*), *Xanthomonas phaseoli* var. *sojense, Pseudomonas glycinea,* and tobacco ring spot virus.

69. ANONYMOUS. 1944. Botany and plant pathology. Rpt. Iowa Agr. Expt. Sta. 1943–44. Part I, pp. 148–175.

The seed treatment tests showed that stand was increased but not the yield of soybean. *Pythium debaryanum, Rhizoctonia* sp., and *Fusarium* spp. were the organisms most frequently obtained from roots of soybean. The anthracnose organism and pod and stem blight organism were commonly obtained from rotting seed. *Colletotrichum glycines* (= *C. dematium* f. *truncata*) often caused severe neck rot at emergence.

70. ANONYMOUS. 1944. Pathology and mycology of corn. Rpt. Iowa Agr. Expt. Sta. 1942–43. Part II, pp. 52–57.

Colletotrichum glycines (= *C. dematium* f. *truncata*), *Fusarium* sp., *Gibberella* sp., *Phomopsis* sp., and *Alternaria* sp. were isolated from soybean seeds.

71. ANONYMOUS. 1944. Botany. Georgia Expt. Sta. 1943–44 Rpt. 56, pp. 53–60.

In Georgia, *Diaporthe sojae* (= *D. phaseolorum* var. *sojae*) was found in one locality on snap bean and in another on cowpea, soybean, and lima bean. Perithecia developed on overwintered stems on all four hosts.

72. ANONYMOUS. 1944. [Verslag over de werkzaamheden van den plantenziektenkundigen dienst in het jaar 1942.] Versl. Meded. Plantenziektenk. Dienst 103.

Soybean was attacked by *Ascochyta* sp.

73. ANONYMOUS. 1945. Report of the federal experiment station in Puerto Rico, 1944. 44 pp.

The most important diseases of soybean in Puerto Rico are seed rots and pre-emergence damping-off, which could be effectively prevented by seed treatment with arasan, semesan, and spergon.

74. ANONYMOUS. 1945. Department of plant pathology. Rpt. Delaware Agr. Expt. Sta. 1944–45. Bull. 259, pp. 33–39.

Soil treatment with dithane at the rate of 100 lb./acre at planting time severely damaged soybean seed.

75. ANONYMOUS. 1945. Botany. Georgia Expt. Sta. 1944–45 Rpt. 57, pp. 48–58.

Diaporthe sojae (= *D. phaseolorum* var. *sojae*) which was commonly present on snap beans, cowpeas, soybeans, and lima beans is distinct from *D. phaseolorum.* Inoculation studies indicated that *D. sojae* is a saprophyte or possibly a weak parasite. Attempts were made to find soybean cultivars resistant to *Sclerotium rolfsii.*

76. ANONYMOUS. 1945. Botany and plant pathology. Rpt. Iowa Agr. Expt. Sta. 1942–44. Part I, pp. 185–223.

Xanthomonas phaseoli var. *sojense* and *Pseudomonas glycinea* were destroyed after 7 weeks in culture solution at 10 F, in freezing tests, though they tolerated 13 weeks at this temperature when dispersed in steamed field soil. Buffered potato-dextrose agar is essential for successful isolation of these pathogens from seeds or from any part of the plant. Seed treatment with new improved cerasan increased emergence.

77. ANONYMOUS. 1946. Hail damage to soybeans. Soybean Dig. 6(8):10–11, 13.

A progress report on the studies of hail damage to soybean. See entries 1035 and 1036.

78. ANONYMOUS. 1946. Botany and plant pathology section. Rpt. Iowa Agr. Expt. Sta. 1945–46. Part I, pp. 166–202.

Pod and stem blight fungus *Diaporthe sojae* (= *D. phaseolorum* var. *sojae*) produced ascigerous stage in culture. It occurred naturally on old stems that had overwintered in the field. Stems collected in March and stored in moist chambers produced matured perithecia in 17 days. The immersed perithecia had long, tapering beaks 347–521 $\times$ 95–150 μ, sessile, elongated-clavate asci contained 8 bicellular ascospores each 10.4–18.5 $\times$ 3.5–5.5 μ. The best medium for pycnidia formation was sterilized seed coat in moist chambers.

79. ANONYMOUS. 1946. Root rot of snap beans. Georgia Agr. Expt. Sta. Ann. Rpt. 58, pp. 68–69.

Diaporthe sojae (= *D. phaseolorum* var. *sojae*) has been found on 12 cultivated plants, including soybean and snap beans.

80. ANONYMOUS. 1946. Diseases of field peas, vetches, soybeans, and other forage legumes. Georgia Agr. Expt. Sta. Ann. Rpt. 58, pp. 74–77.

Seed treatment failed to increase soybean yield. A mild infection of charcoal rot was found on roots and stem bases of mature soybean plants. The plants are probably susceptible to this disease in the pre-emergence stage. Field observations indicate that *Sclerotium rolfsii* can travel over or near the surface of soil and attack nearby plants only when conditions, such as continuously high soil moisture content and the presence of abundant organic matter, are extremely favorable for its growth.

81. ANONYMOUS. 1947. Report on agricultural research for the year ending 30 June 1947. Rpt. Iowa Agr. Expt. Sta. 1946–47. 303 pp.

See entries 929 and 930.

82. ANONYMOUS. 1947. Botany. Georgia Expt. Sta. 1946–47 Rpt. 59, pp. 76–85.

No soybean cultivar highly resistant to *Sclerotium rolfsii* has been found, but plants tend to become resistant with age. Burdette strain 19 was found resistant to *Cercospora sojina.* Cultivars Ogden, Dortchsoy strain 2, Palmetto, CNS, Cherokee, and Louisiana Green showed greatest resistance to wildfire (*Pseudomonas tabaci*).

83. ANONYMOUS. 1948. Plant diseases. Notes contributed by the biological branch. Agr. Gaz. New South Wales 59:527–530.

Records soybean mosaic virus and *Cercospora daizu* (= *C. sojina*) in New South Wales.

84. ANONYMOUS. 1948. Rotation only control for stem rot. Soybean Dig. 8(10):18.

A popular article. Brown stem rot has become increasingly important in the Middle West of the United States. It can be combated by a quadrennial system of crop rotation, with the fungus dying out in 3 years in the absence of the host. It is suppressed by temperatures above 80 F, but causes heavy damage between 60 and 70 F in late summer and early autumn.

85. ANONYMOUS. 1948. Soybeans respond to dusting for disease control. *In* 70th Ann. Rpt. North Carolina Agr. Expt. Sta. Research and Farming 6(3):33.

Six applications of a dust consisting of 7% Cu, 3% DDT, 10% wheat flour, and 80% Cherokee clay at rates of 30, 60, and 90 lb./acre reduced bacterial leaf damage about 50% and increased yield 5.5 bu./acre.

86. ANONYMOUS. 1948. Seed treatment increases yield as well as stand. *In* 70th Ann. Rpt. North Carolina Agr. Expt. Sta. Research and Farming 6(3):32–33.

Treatment of soybean seed with arasan increased the emergence significantly in both greenhouse and field tests. In the field, the increased stands were followed by increased yields of 3.1, 3.8, and 1.7 bu./acre respectively for seeding rates of 4, 8, and 12 seeds/ft.

87. ANONYMOUS. 1948. Report on agricultural research for year ending 30 June 1948. Rpt. Iowa Agr. Expt. Sta. 1947–1948. 390 pp.

Soybean cultivars Lincoln, Richland, Mukden, Habaro, and Manchukoto were equally susceptible when inoculated with *Colletotrichum* sp. Steamed stems inoculated with *Diaporthe phaseolorum* var. *sojae* developed beta spores in pycnidia after 8–25 days, while alpha spores developed at the same time or earlier. Under field conditions homothallic strain was more virulent than heterothallic unless the latter was paired. *Pythium debarynum* root and neck rot occurred in 1.37% of the plants. Seed treatment with arasan reduced *Pythium* infection. A species of *Alternaria* was isolated from irregular to circular brown spots with grey centers occurring on pods and leaves.

88. ANONYMOUS. 1949. Diseases of field peas, lupines, and soybeans, and lupine seed storage problems. Georgia Agr. Expt. Sta. Ann. Rpt. 61, pp. 39–40.

A number of cultivars are listed as showing greatest freedom in the field from bacterial pustule, bacterial blight, frog-eye, wildfire, downy mildew, and Septoria leaf spot.

89. ANONYMOUS. 1950. Under North Carolina growing conditions, Roanoke, Ogden soybean excellent. Seed Worker. 66(2):8–13.

Seed treatment of Roanoke cultivar with arasan resulted in 97% germination compared to 75% for nontreated. In the field, arasan increased the number of plants and yield increased from 23.1 to 26.2 bu./acre. In Rolsoy, Ogden, and Roanoke plants dusted with a mixture of Cu, DDT, wheat flour, and Cherokee clay, 15% or less of the leaf area was affected by bacterial diseases compared to 27% in nontreated leaves. There was a significant increase in yield.

90. ANONYMOUS. 1950. Report on agricultural research for the year ending 30 June 1949. Rpt. Iowa Agr. Expt. Sta. 1948–49. 336 pp.

Most prevalent pathogens on soybeans during the period 22 Sept.–2 Oct. 1948 were *Cephalosporium gregatum*, *Diaporthe phaseolorum* var. *batatatis* (= *D. p.* var. *caulivora*) and *Phyllosticta glycineum* (= *P. sojaecola*). *Pythium* sp. was isolated consistently from nongerminating seeds in soil.

91. ANONYMOUS. 1951. Sixty-second annual report. Georgia Expt. Sta. 1949–50. 92 pp.

Soybean cultivars L4-6290, Ogden, Hale, Dortchsoy, N540-1, N45-2885, N45-3728, N45-2994, Oklahoma 710, F.C. 31592, Cherokee, and Seminole possess some degree of resistance to *Xanthomonas phaseoli* var. *sojense.*

92. ANONYMOUS. 1951. Report of the Iowa Agr. Expt. Sta. for the two years 1 July 1949 to 30 June 1951. Part I. 74 pp.

Soybean stem canker (*Diaporthe phaseolorum* var. *batatatis*) cost Iowa growers nearly $4 million during 1950. Fifteen out of 189 lines tested were considerably more resistant than Lincoln in both the 1949 and 1950 trials. Brown stem rot (*Cephalosporium gregatum*) also was prevalent in eastern Iowa during this period. Crop rotation offers the most practicable method of control. Increased field stands of Hawkeye were obtained by 10% by seed treatment with arasan and 7% with spergon representing yield increases of only 1 and 0.3 bu., respectively, over the untreated. Addition of bacterial inoculum to nontreated seed increased the yield by only 0.3 bu., or to about the same level as for treating inoculated seed. Of 16 lots of Adams soybeans given seed treatment, six, four, and one lot showed increased [?stands] on an average by 7.9, 24.7, and 36.4% respectively. Five lots did not benefit.

93. ANONYMOUS. 1952. Notes on current investigations, July to September, 1952. Malaya Agr. Jour. 35:217–218.

Soybean was attacked by *Rhizoctonia solani* in Malaya.

94. ANONYMOUS. 1952. Seed treatments and inoculations for soybeans. Soybean Dig. 12(5):14–16.

Experiments by the Nitrogen Co., Inc., in Wisconsin to determine effect of seed treatment with arasan, phygon, and spergon on nodule bacteria (*Rhizobium* sp.) of Lincoln and Hawkeye soybean. It was found that, although the fungicides adversely affect nodulation, treated seed may be inoculated successfully if reasonable precautions are observed. These include inoculation immediately prior to planting, preferably by the "wet" method, maintaining high soil moisture content, and using increased dosages of inoculum to offset injury to the bacteria caused by the treatments.

95. ANONYMOUS. 1952. Diseases in the Minnesota-Iowa-Missouri area. Soybean Dig. 12(9):15.

A brief popular account of seasonal occurrences and effects of bacterial blight, bacterial pustule, wildfire, brown spot, downy mildew, frog-eye leaf spot, *Phyllosticta,* Alternaria leaf spot, bud blight, mosaic, yellow mosaic, seed stain, K deficiency, seedling blight caused by *Pythium* and *Rhizoctonia,* anthracnose fungus, and charcoal rot.

96. ANONYMOUS. 1953. Report of the minister of agriculture, Canada, for the year ended 31 March 1953. 143 pp.

Pod and stem blight of soybean (*Diaporthe phaseolorum* var. *sojae*) is as destructive as stem canker (*D. p.* var. *batatatis*) (= *D. p.* var. *caulivora*) and both diseases significantly reduce yields, especially of late-maturing cultivars.

97. ANONYMOUS. 1953. Distribution, symptoms and control of some of the more important plant diseases. Plant Dis. Reptr. Suppl. 221:107–181.

Lists diseases caused by the pathogens *Pseudomonas glycinea, Xanthomonas phaseoli* var. *sojense, Cephalosporium gregatum, Cercospora kikuchii, C. sojina, Diaporthe phaseolorum* var. *sojae,* tobacco ring spot virus, mosaic virus, and yellow mosaic virus.

98. ANONYMOUS. 1954. Annual report of the Dept. of Agr., Uganda Protectorate, for the year ended 3 December 1953. 106 pp.

Soybeans were affected by a nonidentified virus disease.

99. ANONYMOUS. 1955. Results of 1954 fungicide tests. Agr. Chem. 10 (4):47–51, (5):39–42, 113, (6):-53–59, 125, 127.

Damping-off of soybean in Ontario was adequately controlled by seed treatment with orthocide or vancide.

100. ANONYMOUS. 1957. The soybean cyst nematode. U.S. Dept. Agr. PA-333. 4 pp.

A general, illustrated publication on the soybean cyst nematode (*Heterodera glycines*). Kind of damage, the nematode's life cycle, spread, detection, and control measures are discussed.

101. ANONYMOUS. 1958. Annual report of the Dept. of Agr., Tanganyika, 1957. Part II. 85 pp.

Anthracnose (*Glomerella glycines*) of soybean is reported, a new record in Tanganyika.

102. ANONYMOUS. New Lee soybean. Seed World 74(12):27.

Lee cultivar is reported to be resistant to *Xanthomonas phaseoli* var. *sojense, Pseudomonas tabaci, Cercospora sojina,* and *C. kikuchii.*

103. ANONYMOUS. 1960. Distribution of plant-parasitic nematodes in the South. South. Coop. Bull. 74. 72 pp.

A report by cooperators in the southern United States (S-19 Committee) on the known distribution of the plant-parasitic nematodes. Many nematodes attack soybeans. Sixty-eight species and genera are listed.

104. ANONYMOUS. 1961. Annual report of Agr. Expt. Sta., Florida, for the year ending 30 June 1960. 364 pp.

Verticillium albo-atrum was recovered from inoculated symptomless soybean plants.

105. ANONYMOUS. 1962. Record of research work carried out in 1960. Dept. of Agr. Tanganyika. 116 pp.

A new record of soybean mosaic virus on soybean in Tanganyika.

106. ANONYMOUS. 1962. Report of the research station, Harrow, Ontario, 1959–1960. 32 pp.

Following an unusually hot, humid summer in 1959, soybean seed was infected with *Diaporthe* sp. The fungus was controlled by chloranil, thiram, and captan.

107. ANONYMOUS. 1963. Annual report of the Dept. of Agr., Nyasaland, for the year 1961–62. Part II. 169 pp.

Xanthomonas phaseoli var. *sojense* a new record on soybean in Nyasaland.

108. ANONYMOUS. 1963. Rhodesia and Nyasaland Min. Agr., Rpt. of the Sec. 1961–62, pp. 46–55.

Cercospora kikuchii, causing blue stain on soybean seeds, is a new record for the Federation of Rhodesia and Nyasaland. Bacterial blight was commonly encountered. Inspection of crops in variety trials showed that several cultivars were infected by soybean mosaic virus. The cultivar Hood carried a very heavy infection.

109. ANONYMOUS. 1963. New resistant varieties. Soybean Dig. 23:25.

Cultivars Hawkeye 63, Clark 63, Harosoy 63, and Lindarin 63, resistant to Phytophthora root and stalk rot, were developed to replace the commercial cultivars Hawkeye, Clark, Harosoy, and Lindarin.

110. ANONYMOUS. 1963. Plant pathology. Rpt. Res. Branch, Min. African Agr. North Rhodesia 1962–63, pp. 42–47.

Pseudomonas glycinea, P. tabaci, and *Xanthomonas phaseoli* var. *sojense* caused diseases on soybean leaves in North Rhodesia.

111. ANONYMOUS. 1963. Bacterial diseases of soybean [in Russian]. Trudy Inst. Zashch Rast Thikigi. 15:-341–348.

Bacterial spot attacks mainly the leaves of Georgian cultivar of soybean. All pathogenic isolates were similar to *Pseudomonas phaseoli* var. *sojense* (= *Xanthomonas phaseoli* var. *sojense*).

112. ANONYMOUS. 1963. Plant breeding section. North Rhodesia Min. African Agr. Ann. Rpt. 1962, p. 22.

In three variety trials the cultivar Hill had a higher resistance than others to bacterial blight (*Pseudomonas glycinea*).

113. ANONYMOUS. 1963. Report of the Dept. of Agr., New South Wales, for the year ended 30 June 1963. 148 pp.

Soybeans were affected by *Xanthomonas phaseoli* var. *sojense* and *Macrophomina phaseoli* (= *M. phaseolina*) in New South Wales.

114. ANONYMOUS. 1964. Plant disease survey for the twelve months ending 30 June 1963. Biol. Branch, New South Wales Dept. Agr., 33rd Ann. Rpt.

Leaf spot (*Cercospora* sp.) on *Glycine javanica* was prevalent and widespread on the far North Coast during the late winter and early spring of 1962. The fungus resembles *Cercospora canescens,* which is a new record for New South Wales.

115. ANONYMOUS. 1964. Plant pathology. Northern Rhodesia Min. African Agr. Ann. Rpt. 1963, pp. 23–25.

Bacterial blight of soybeans yielded three organisms: *Pseudomonas glycinea, Xanthomonas phaseoli* var. *sojense,* and *Pseudomonas tabaci.* Soybean is therefore a confirmed host of the wildfire bacterium (*P. tabaci*). A similar disease was noted on the wild *Glycine javanica.*

116. ANONYMOUS. 1964. Botany, plant pathology, and seed services. Rpt. Min. Agr. Rhodesia, Nyasaland. 1963, pp. 45–53.

New record of *Colletotrichum* sp. on soybeans in Rhodesia.

117. ANONYMOUS. 1964. Annual report East African Agr. and For. Org. 1963. 107 pp.

A rare virus causing witch's broom symptoms on soybean was noted.

118. ANONYMOUS. 1964. Annual report of the Agr. Expt. Sta., Florida, for the year ending 30 June 1963. 386 pp.

Citrus variegation virus (strain of citrus psorosis virus) can infect Bansei soybean.

119. ANONYMOUS. 1965. Botany, plant pathology, and seed services. Rpt. Min. Agr. Rhodesia. 1 December 1963 — 30 September 1964, pp. 81–92.

Peronospora manshurica new record on soybean in Rhodesia.

120. ANONYMOUS. 1965. Plant pathology. Results of Res. Agr. Expt. Sta. Univ. of Kentucky 78, pp. 66–69.

Sclerotium rolfsii was isolated from soybean in central Kentucky.

121. ANONYMOUS. 1965. Annual report, East African Agr. and For. Res. Org., 1964. 147 pp.

Attempts to transmit witch's broom virus to soybean with *Cuscuta* spp. were unsuccessful.

122. ANONYMOUS. 1966. Annual report, East African Agr. and For. Res. Org., 1965. 201 pp.

Experiments comparing the effects of soybean witch's broom virus (SWBV) and groundnut rosette virus (GRV) on soybean are described. The two viruses may be related but not identical. SWBV was transmitted to but not recovered from groundnut and GRV was trans-

mitted to soybean by grafting or aphid but was recovered only when graft transmitted. Also described are symptoms of a severe soybean virus disease, transmitted by grafting or mechanically.

123. ANONYMOUS. 1968. Plant pathology. Rpt. Sec. Agr. Rhodesia 1 October 1966 — 30 September 1967, p. 31.

Colletotrichum glycines (= *C. dematium* f. *truncata*) recorded as a new disease in Rhodesia.

124. ANONYMOUS. 1968. Annual report East African Agr. and For. Res. Org. 1967. 158 pp.

Cowpeas were affected by a complex of two viruses designated cowpea-N and cowpea-C. Cowpea-N was also prevalent alone on soybean and cowpea, but cowpea-C was not detected alone. In some respects the virus cowpea-N resembles soybean mosaic virus, but it has a wider host range.

125. ANONYMOUS. 1968. Plant pathology department, Sec. Agr. Rhodesia, 1 October 1966 — 30 September 1967.

New record of *Colletotrichum glycines* (= *C. dematium* var. *truncata*) on soybean in Rhodesia.

126. ANONYMOUS. 1969. Annual report East African Agr. and For. Res. Org. 1968. 183 pp.

Peanut mottle virus caused systemic infection in soybeans.

127. ANONYMOUS. 1969. Thirty-ninth annual plant disease survey for year ending 30 June 1969. New South Wales Dept. Agr., Div. of Sci. Ser., Biol. Branch.

Sclerotinia (= *Whetzelinia*) *sclerotiorum* is recorded for the first time in New South Wales.

128. ANONYMOUS. 1970. Pests and diseases outbreak and their control. Plant Path. Rpt. Min. Agr. Nat. Res. Guyana. 1967 (III):6–9, 16–21; 1968(III):15–17.

Pseudomonas glycinea was found infecting leaves, stems, and pods of soybean in Guyana.

129. ANONYMOUS. 1970. 83rd annual report fiscal year ending 30 June 1970. Mississippi Agr. For. Expt. Sta. 126 pp.

Mentions soybean cultivars that are resistant to root-knot and soybean-cyst nematodes. This resistance is combined with tolerance to fungal diseases.

130. ANONYMOUS. 1970. Report on the breeding of the new soybean varieties Raiden and Raiko by means of irradiation [in Japanese]. Tohuku Agr. Expt. Sta. Bull. 40, pp. 65–105.

This report on soybean cultivars Raiden and Raiko discusses their breeding by means of irradiation. The cultivars are tolerant to *Heterodera glycines*.

131. ANONYMOUS. 1971. Stress test for soybean seed has been developed. Iowa Cert. Seed News (Jan. 1971): 2–4.

Soybean seed is placed in a high-humidity chamber at 40 C for 30 hr., then planted in sterile sand at 25 C and germinated. After 7 days, germination counts are made. If germination is over 90% and the stress test over 80%, the seed is satisfactory for planting. If stress is below 60%, seed lot is rejected for planting. Seed between 60–80% is questionable; if used, a good seed treatment material should be applied.

132. ANONYMOUS. 1971. Annual report East African Agr. and For. Res. Org. 1970. 170 pp.

Field symptoms of soybean virus isolates were of two main types — leaf distortion (designated soya crinkle virus) and yellow mottle. Soya crinkle virus is similar to soybean mosaic virus and is associated with filamentous particles 750 nm long. Isometric particles were found in two isolates including yellow mottle.

133. ANONYMOUS. 1972. Annual report East African Agr. and For. Res. Org., record of research for 1971. Nairobi, Kenya.

A 750 nm filamentous virus infecting groundnut and other legumes including soybean is most widespread in East Africa, where they are confined to the lower altitudes. In host range studies it was found that soybean crinkle virus isolates were similar to groundnut 750 nm virus. Two soybean virus isolates from West Kenya which induced yellow mottle symptoms appeared similar to East Uganda isolate.

134. ANONYMOUS. 1972. Annual report 1971–1972. Queensland Dept. of Primary Industries. 48 pp.

Pseudomonas tabaci occurred throughout South East Queensland on soybean cultivars Wills and Hampton, showing worthwhile resistance earlier.

135. ANONYMOUS. 1973. Plant pathology, seedlings diseases. 1972 Rpt. Grain Legume Imp. Prog., Int. Inst. Trop. Agr., Ibadan, pp. 41–61.

Results for a series of tests on seed treatments with various systemic fungicides (benlate, demosan, vitavax) on cowpea and soybeans.

136. ANONYMOUS. 1973. Bacterial pustule. 1972 Rpt. Grain Legume Imp. Prog., Int. Inst. Trop. Agr., Ibadan.

Results of screening 351 lines of soybean for resistance to *Xanthomonas phaseoli* var. *sojense*. Eighty-eight lines developed slight disease and 25 were free of the disease. Of the 88 lines, about 50% showed high resistance.

137. APPLEMAN, M. D. 1942. Effect of seed treatment on nodulation of soybeans and peas. Proc. Soil Sci. Soc. Amer. 6:200–203.

Satisfactory nodulation was produced upon pea and

soybean plants grown from inoculated seed treated with semesan. Cuprocide prevented nodulation on soybean and canning pea plants. Ceresan decreased nodulation on canning peas but not on soybean plants. All nodulation was of the lateral root type where seed disinfectants were used, although tap-root nodulation was obtained upon the nontreated inoculated controls. The organisms were recovered from disinfectant-treated, inoculated seed after a lapse of 24 hours.

138. ARMSTRONG, G. M., and J. K. ARMSTRONG. 1948. Nonsusceptible hosts as carriers of wilt *Fusaria.* Phytopathology 38:808–826.

Sweet-potato wilt *Fusarium* and tobacco wilt *Fusaria* were recovered from inoculated soybean which exhibited no external symptoms.

139. ARMSTRONG, G. M., and J. K. ARMSTRONG. 1949. The Fusarium wilt of cowpeas and soybeans. Phytopathology 39:1. (Abstr.)

An abstract of entry 140.

140. ARMSTRONG, G. M., and J. K. ARMSTRONG. 1950. Biological races of the *Fusarium* causing wilt of cowpeas and soybeans. Phytopathology 40:181–193.

Two races of *Fusarium oxysporum* f. *tracheiphilum* were differentiated by pathogenicity. Race 1 obtained from both soybean and cowpeas caused wilting of some cultivars of both hosts; while race 2, obtained only from cowpeas, caused severe wilting only in some cultivars of this host. The cowpea cultivars, Lady Finger and Sumptuous, served as excellent differentials for these two races. Lady Finger was killed readily by race 1 but showed practically no symptoms with race 2; whereas Sumptuous reacted vice versa.

141. ARMSTRONG, G. M., and J. K. ARMSTRONG. 1965. A wilt of soybean caused by a new form of *Fusarium oxysporum.* Phytopathology 55:237–239.

A blight or wilt of soybean was found in South Carolina in 1961. These experiments showed that the causal agent, *Fusarium oxysporum,* was neither race 1 of the *Fusarium* causing wilt of cowpea nor race 2 of the *Fusarium* causing wilt of cotton, both known to cause wilt of soybean. *F. oxysporum glycines* is the name proposed for the causal organism. The new form caused wilt of soybean but was nonpathogenic on certain species and cultivars of 31 other genera of plants that were inoculated. Most of these have been helpful in differentiating forms and races of the wilt *Fusaria.*

142. ARMSTRONG, J. K., and G. M. ARMSTRONG. 1958. A race of cotton wilt *Fusarium* causing wilt of Elredo soybean and flue-cured tobacco. Plant Dis. Reptr. 42:147–151.

Race 2 of *Fusarium oxysporum* f. *vasinfectum* caused wilting of soybeans planted in infested field soil.

143. ARSENIJEVIC, M., and B. KOSTIC. 1960. A contribution to the study of *Peronospora manshurica* (Naum.) Syd. [in Croatian, English summary]. Zashtita Bilja 62:139–144.

Since the cultivation of soybeans has increased in recent years in Yugoslavia, this disease has become common and dangerous during the entire growing season. Blackhawk and Goldsoy were the most heavily attacked.

144. ARX, J. A. V. 1957. The species of the genus *Colletotrichum* Cda [English summary]. Phytopath. Z. 29:413–468.

Colletotrichum destructivum was isolated from soybean. General discussion on nomenclature and morphology of the fungus.

145. ASAI, K., M. NISHIO, and T. OKADA. 1964. [Outbreaks of *Heterodera glycines.*] Soc. Plant Prot. No. Japan, Ann. Rpt. 15, pp. 138–139.

Distribution of *Heterodera glycines* in Japan is reported.

146. ASAI, K., and Y. NISHIO. 1965. Seasonal prevalence of soybean-cyst nematode: The influence of D-D treatment of soil [in Japanese, English summary]. Hokkaido Natl. Agr. Expt. Sta. Res. Bull. 86, pp. 40–43.

The effect of soil fumigation with DD on the seasonal prevalence of soybean-cyst nematode (*Heterodera glycines*) was studied. The number of larvae in soil and in root tissue was reduced to a markedly low level by soil fumigation during almost the entire soybean growing season. Growth of soybean was excellent in fumigated soil but at harvest time there was no difference in number of cysts on plants in fumigated and nonfumigated soil.

147. ASHBY, S. F. 1927. *Macrophomina phaseoli* (Maubl.) comb. nov., the pycnidial stage of *Rhizoctonia bataticola* (Taub.) Butl. Brit. Mycol. Soc., Trans. 12:141–147.

Taxonomy is discussed and nine synonyms are listed. A good survey of the literature is given.

148. ATANASOFF, D. 1934. [Virus diseases of plants.] A bibliography. 219 pp.

149. ATANASOFF, D. 1937. Virus diseases of plants. A bibliography. Suppl. I. Phytopath. Z. 10:339–463.

150. ATANASOFF, D. 1940. Virus diseases of plants. A bibliography. Suppl. II. Phytopath. Z. 12:511–584.

151. ATHOW, K. L., and A. H. PROBST. 1952. Indiana soybean disease survey 1952. Purdue Agr. Expt. Sta. Mimeo. BP-52. 7 pp.

152. ATHOW, K. L., and A. H. PROBST. 1952. The inheritance of resistance to frog-eye leaf spot of soybeans. Phytopathology 42:660–662.

The F_2 segregation in six crosses of resistant × susceptible soybean cultivars was studied under conditions of natural infection to *Cercospora sojina,* causal fungus of frog-eye leaf spot. Resistance in the crosses studied was found to be due to a single major dominant Mendelian factor. The symbols Cs, cs have been assigned to this gene pair.

153. ATHOW, K. L., and R. M. CALDWELL. 1954. A comparative study of Diaporthe stem canker and pod and stem blight of soybean. Phytopathology 44:319–325.

A comparison is presented of *Diaporthe* spp., the organisms responsible for these two diseases. Diaporthe stem canker is an acute disease causing death of actively growing plants as a result of rapid development of stem-girdling lesions. The causal organism is here recognized as a variety of *D. phaseolorum* under the trinomial *D. phaseolorum* var. *caulivora* and a technical description is presented. Pod and stem blight is a slow-developing disease which occasionally causes slightly premature ripening and a discoloration of a small portion of the pith of infected plants. It is characterized by linear rows of pycnidia on mature, dead, or moribund stems, petioles, and pods. The trinomial, *D. phaseolorum* var. *sojae* is retained as the valid name of the fungus causing the pod and stem blight disease of soybean. *D. phaseolorum* var. *caulivora* is differentiated from *D. phaseolorum* var. *sojae* by its lack of a conidial stage, the production of perithecia in caespitose groups instead of singly, shorter and more tapering perithecial beaks, and smaller asci and ascospores.

154. ATHOW, K. L., and R. M. CALDWELL. 1956. The influence of seed treatment and planting rate on the emergence and yield of soybeans. Phytopathology 46:91–95.

In a 4-year test to determine the effect of seed treatment and planting rate on emergence and yield of soybeans in spaced-row and large drill-plot tests, results were dependent upon seed quality, planting rate, and to some extent, environmental conditions prevailing at time of and following planting. Treatment of poor-quality seed with arasan or spergon usually improved emergence and in some instances significantly increased the yield. Under conditions of accurate hand-spacing, treatment of good-quality seed resulted in only slightly improved emergence and no significant effect on yield except at the lowest seeding rate (4-in. spacing). At this low seeding rate, however, yields were significantly lower than from nontreated seed at spacing intervals of 1 to 3 in. In plots seeded with a conventional grain drill, yields were reduced regardless of seed treatment when seeding rates were below a calculated average seed spacing of 1½ in. because of lack of uniform spacing obtained. This precluded the possibility of maximum yields by combining seed treatment, and significantly reduced seeding rates under standard field practice. Results of these trials conducted under conditions both favorable and unfavorable for emergence and establishment of stand indicate that seed treatment may be of value when seed of poor quality is used or seeding is at a very low rate. Under standard seeding rates and using reasonably good seed, however, no practical value of seed treatment has been demonstrated.

155. ATHOW, K. L. 1957. Studies of soybean infection by the stem canker fungus. Phytopathology 47:2. (Abstr.)

Observations on time and place of natural infection by the soybean stem canker fungus, *Diaporthe phaseolorum* var. *caulivora,* have been made for 8 years. In date-of-planting studies in which plantings were made at approximately five weekly intervals, stem lesions never were observed before plants were 62 days old, irrespective of the date this age was reached. The earliest observable infection in 31 of the 40 plantings was noted on plants 70–80 days old; however, artificial inoculation of plants 28 and 35 days old resulted in 50 and 85% infection, respectively. It was demonstrated that practically all natural infection takes place through leaves. The exact site of infection has not been determined, but observations indicate that it is either the leaf blade or the juncture of leaflets and petiole. The growth of the fungus from this junction through the petiole into the main stem has been followed by isolations from different sites on petioles in various stages of infection. Removal of the first 6 trifoliolate leaves before plants were 58 days old resulted in no infection. In adjacent check rows, from which no leaves were removed, as high as 36% of plants were infected.

156. ATHOW, K. L., and J. B. BANCROFT. 1959. Development and transmission of tobacco ring spot virus in soybean. Phytopathology 49:697–701.

One hundred percent seed transmission of tobacco ring spot virus, the incitant of the bud blight disease, has been observed in soybean. Efficiency of seed transmission depends on time of infection of seed-bearing plants. The virus is associated with the embryonic tissue of the seed but not with the seed coat. Epidemiological studies show that incidence of the disease can be correlated with the type of crop adjacent to soybean fields. Indirect evidence indicates that insect transmission is responsible for spread of the disease since the virus is not soil-transmitted and seed transmission under natural conditions does not account for the rapid increase of the disease during epiphytotics.

157. ATHOW, K. L., and F. A. LAVIOLETTE. 1961. The relation of seed-transmitted tobacco ring spot virus to soybean yield. Phytopathology 51:341–342.

Seed from infected plants produced 88–93% infected plants, but no significant differences in yield occurred until 50% of such seeds were mixed with healthy seeds.

A significant yield reduction occurred when seeds from 93% infected plants were used.

158. ATHOW, K. L., A. H. PROBST, C. P. KURTZMAN, and F. A. LAVIOLETTE. 1962. A newly identified physiological race of *Cercospora sojina* on soybean. Phytopathology 52:712–714.

Race 2 found on Clark and Wabash in 1959. Cultivars resistant to both races 1 and 2 are CNS, Dorman, Hood, Kanrich, Kent, Kim, Lee, Ogden, and Roanoke.

159. ATHOW, K. L., and F. A. LAVIOLETTE. 1962. Relation of seed position and location to tobacco ring spot virus seed transmission in soybean. Phytopathology 52:714–715.

There was no relationship between seed transmission of the virus and position of seed in pod or pod location on the plant.

160. ATHOW, K. L., and F. A. LAVIOLETTE. 1973. Pod protection effects on soybean seed germination and infection with *Diaporthe phaseolorum* var. *sojae* and other microorganisms. Phytopathology 63:1021–1023.

Soybean seed was harvested when mature and 6 weeks after maturing from nonprotected pods and pods protected from 5 weeks before maturity until 6 weeks after maturity, to compare germination and infection with *Diaporthe phaseolorum* var. *sojae* and other microorganisms. Protection prior to ripening did not affect germination or infection. Protecting pods for 6 weeks after maturity significantly increased germination and reduced infection with *D. phaseolorum* var. *sojae, Alternaria* spp., and miscellaneous microorganisms. The data do not clearly indicate time of greatest infection with *D. phaseolorum* var. *sojae,* but infection with *Alternaria* and miscellaneous microorganisms progressively increased when protection was delayed two or more weeks after maturity. Pod protection or time of harvest did not influence infection with *Cercospora kikuchii.* Stem inoculation with *D. phaseolorum* var. *sojae* did not increase seed infection.

161. ATHOW, K. L. 1973. Fungal diseases. *In* B. E. Caldwell (ed.) Soybeans: improvement, production, and uses. Amer. Soc. Agron. Madison, Wis., pp. 459–489.

A brief literature review of soybean disease with emphasis on symptoms, epidemiology, and control of fungus diseases.

162. ATHOW, K. L., F. A. LAVIOLETTE, and T. S. ABNEY. 1974. Reaction of soybean germplasm strains to four physiologic races of *Phytophthora megasperma* var. *sojae.* Plant Dis. Reptr. 58:789–792.

Physiologic races 3 and 4 of *Phytophthora megasperma* var. *sojae* were isolated from soybeans for the first time in Indiana. The reactions of 266 soybean germplasm strains to races 1, 2, 3, and 4 are reported, including 95 strains resistant to all four races.

163. ATIENZA, M. 1927. Sclerotium disease of tomato and pepper. Philipp. Agr. 15:579–588.

Sclerotium rolfsii isolated from tomato and pepper is pathogenic to wound-inoculated soybean.

164. ATKINS, J. G., and W. D. LEWIS. 1952. Rhizoctonia aerial blight of soybeans in Louisiana. Phytopathology 42:1. (Abstr.)

Rhizoctonia aerial blight was observed in soybean variety plots at Baton Rouge in 1950 and 1951. This disease was more severe in 1951 on certain cultivars than the other common foliage diseases. Cultivars differed considerably in susceptibility, with Dortchsoy 31 and Ogden conspicuously more susceptible than others in the field. Symptoms ranged from definite spots to complete killing of leaves, petioles, pods, and young stems. Severely affected plants were nearly defoliated. Leaves two or three feet above the soil surface were frequently attacked. Typical *Rhizoctonia* mycelium developed on or between infected leaflets. Small sclerotia of the *R. microsclerotia* type were produced abundantly in 1951. In controlled tests, isolates caused leaf blight on soybeans, snap beans, lima beans, cowpeas, fescue, trefoil, lespedeza, fig, and tung. In addition to the microsclerotia type of *Rhizoctonia,* other types can cause leaf blight on soybeans. The disease, pathogen, and conditions favoring development are the same as for web blight or similar blights of snap beans and certain other southern crops as reported by various workers. In areas having favorable environmental conditions, this blight should be considered a potentially destructive disease.

165. ATKINS, J. G., and W. D. LEWIS. 1954. Rhizoctonia aerial blight of soybeans in Louisiana. Phytopathology 44:215–218.

The disease is caused by *Corticium microsclerotia* (= *R. solani*) and is characterized by leaf spot, leaf blight, and defoliation. The necrotic areas vary in shape from circular to irregular with indefinite margins and are greenish brown to reddish brown. High temperature and high humidity are necessary for disease development.

166. ATKINSON, R. E. 1943. Soybean diseases in the Carolinas. Plant Dis. Reptr. 27:603–604.

Records the occurrence of *Peronospora manshurica, Sclerotium rolfsii, Glomerella glycines, Cercospora sojina, S. bataticola* (= *Macrophomina phaseolina*), *Helminthosporium* sp., *Pseudomonas glycinea, Xanthomonas phaseoli* var. *sojense,* and mosaic virus.

167. ATKINSON, R. E. 1944. Diseases in North Carolina. Plant Dis. Reptr. 28:687.

Dry weather in the Piedmont has been hard on soybeans, but has probably kept leaf diseases at a minimum this

season. However, *Pseudomonas glycinea, Cercospora sojina, Peronospora manshurica,* and mosaic virus were found. They are not of economic importance at this time. A marginal leaf spot on which a *Phyllosticta* sp. was fruiting was observed on the lower leaves in one field.

168. ATKINSON, R. E. 1944. Soybean diseases in Virginia and West Virginia. Plant Dis. Reptr. 28:1008.

Records prevalence of the following diseases: Leaf spots caused by *Cercospora cruenta* and *C. canescens, Glomerella glycines,* Phyllosticta leaf spot, *C. sojina, Peronospora manshurica,* and *Pseudomonas tabaci.*

169. ATKINSON, R. E. 1944. Diseases of soybeans and peanuts in the Carolinas in 1943. Plant Dis. Reptr. Suppl. 148:254–259.

Records occurrence and prevalence of *Xanthomonas phaseoli* var. *sojense, Pseudomonas glycinea,* mosaic virus, *Cercospora sojina, Glomerella glycines, Sclerotium rolfsii, S. bataticola* (= *Macrophomina phaseolina*), *Fusarium* spp., *Heterodera marioni, Nematospora* sp., *Diaporthe sojae* (= *D. phaseolorum* var. *sojae*), and *Septoria glycines.*

170. ATLAS DE GOTUZZO, E. 1970. Microorganisms isolated from normal and spotted soybean seed, their effect on the percentage of germination [English summary]. Revta Fac. Agron. Vet. Univ. (Buenos Aires) 18:7–16.

Of the bacteria and fungi isolated from apparently healthy soybean seeds with low germination and kept under different conditions (storage period, relative humidity at harvest, treatment with spergon), only *Pseudomonas glycinea, Xanthomonas phaseoli* var. *sojense,* and *Fusarium solani* reduced germination on inoculation in the glasshouse. Of the isolates from spotted seeds only these three and *Phomopsis sojae* reduced germination. A direct correlation between type of spot and causal agent was found only for *P. sojae* and *Nematospora* sp. The organism on stained seeds remained viable after 10 months of storage.

171. AVERE, C. W., and K. L. ATHOW. 1964. Host-parasite interaction between *Glycine max* and *Phytophthora megasperma* var. *sojae.* Phytopathology 54:886–887. (Abstr.)

Thirty-one isolates of *Phytophthora megasperma* var. *sojae* from the United States and Canada varied in virulence when stem-inoculated in soybean cultivars Harosoy, Dunfield (both susceptible), and Mukden (resistant). Virulence was not associated with growth rates and oospores formation or with morphological characteristics in culture. Highly virulent isolates gave clear-cut susceptible (killed) or resistant (no infection) reactions depending on the cultivar. Weakly virulent isolates gave either many nonkilling lesions or no infection in seedlings of Dunfield and Harosoy. In inoculation tests with virulent isolates, the F_1, F_2, F_3 backcross and testcross generations from the diallele cross involving Harosoy or Dunfield × Mukden showed that Mukden had a single, dominant gene, Ps, which conditions resistance. The recessive allele, ps, conditioned susceptibility in Dunfield and Harosoy. Inheritance of resistance was difficult to interpret when weakly virulent isolates were used because of the number of noninfected and poorly infected plants.

172. AYAYDIN, F. 1973. Downy mildew of soybean; a disease recently recorded in Turkey. J. Turkish Phytopath. 2:85–87.

Peronospora manshurica newly recorded on soybean in Turkey. Symptoms and morphology of the fungus are described.

172a. AYERS, A., J. EBEL, and P. ALBERSHEIM. 1974. A highly potent elicitor of hydroxyphaseollin synthesis in soybean tissues has been purified from the culture filtrates of *Phytophthora megasperma* var. *sojae.* Proc. Amer. Phytopath. Soc. 1:23. (Abstr.)

A glucan, isolated from culture filtrates of *Phytophthora megasperma* var. *sojae* grown on a minimal, defined medium, elicits synthesis of the phytoalexin hydroxyphaseollin when applied to cut surfaces of soybean cotyledons and hypocotyls. This elicitor has been highly purified by ion exchange and gel permeation chromatography. It is stable to heating (121 C for 5 min.), protease digestion, and variations in pH from 2 to 10. If amino acids are present they represent a very small portion of the elicitor. Gas chromatographic analysis demonstrates that glucose is the predominant glycosyl constituent of the elicitor although minor amounts of other glycosyl constituents are present. The elicitor is heterogeneous in size, varying from 4,000 to 40,000 daltons, and appears to be related to the cell wall polysaccharides of *Phytophthora* spp. Very small quantities of highly purified elicitor are needed to stimulate synthesis of hydroxyphaseollin. Application of 10 mg of elicitor (approximately 10^{-13} moles) to the cut surface of a soybean cotyledon elicits synthesis of sufficient extractable hydroxyphaseollin to be detectable in a bioassay for fungitoxicity. Preliminary experiments to determine if the purified elicitor has the same host specificity as the race of *P. megasperma* var. *sojae* that produced the elicitor have not been conclusive.

173. BABAYAN, D. N., and B. G. ANASTASYAN. 1968. [Representatives of the genus *Septoria* parasitizing leguminous plants.] Uchen. Zap. erevan. Univ. Estestv. n. 107:93–108.

Brief description, taxonomy, and distribution of *Septoria* spp. on soybeans.

174. BABOVIC, M., and R. NUMIC. 1966. Contribution to the study of bacteria of soybean in West Serbia [English summary]. Zast. Bilja 17(91–92):331–335.

Symptoms of the disease caused by *Pseudomonas glycinea* in Yugoslavia and morphology and biochemistry of the pathogen are described.

175. BACKMAN, P. A., and R. RODRIGUEZ-KABANA. 1973. Efficacy of fungicide-nematicide combinations for seed treatment of soybeans. 2nd Internatl. Cong. Plant Path. Abstrs. 0856.

Seeds of two soybean cultivars (Hood and Lee) were treated with fungicides, nematicides, and fungicide-nematicide combinations. Fungicides were applied at 2.5–4.0 g/kg seed and nematicides were added to achieve an in-furrow rate of 1.0 kg/ha when seed were planted at standard intervals. Each treatment consisted of a 2-row plot replicated 10 times in a randomized complete block design. One row of each plot was planted to each variety. The test was conducted in a field planted to corn the previous year. Plots were read for emergence 18 days after planting, and soil samples for nematodes (15 cm) were taken in the root zone at 30 days. Nematodes were quantitated using the molasses flotation technique. Fungicides resulted in marked increases in emergence, while nematicides had no direct phytotoxic effect. The nematicide carbofuran significantly reduced total nematode numbers including all pathogenic nematodes present, and most saprophytic species. An oxime nematicide was much more erratic in response, causing no significant reduction in total nematodes. Synergistic and antagonistic interactions were observed between nematicides and fungicides as demonstrated by effect on total nematode numbers. This study indicates that nematicides can be delivered on fungicide-treated seed at effective rates, reducing operational cost.

176. BAEZA, A. C. A. 1971. Angular spot *Septoria glycines* a new disease of soybean in the departments of Valle and Cauca [in Spanish]. Acta Agron. Palmira 21:-83–85.

The fungus was newly recorded in Colombia on crops 30–90 days old. Symptoms, factors favoring spread, and cultivars affected are described.

177. BAIN, D. 1944. Diseases on soybean in Louisiana. Plant Dis. Reptr. 28:540–541.

Records occurrence of *Peronospora manshurica* only on lower leaves of plants, *Cercospora sojina,* and mosaic. Two different leaf diseases were also noted. One characterized by a very faint yellow blotching and water-soaked appearance confined to veins on lower surface of leaves. Aphids were found on some leaves. In the other disease large brown spots surrounded by a wide chlorotic halo were present. Bacteria were found to be associated with both diseases.

178. BAIN, D. C. 1944. Diseases on soybean in Missisippi. Plant Dis. Reptr. 28:630.

Records occurrence of charcoal rot and bacterial pustule.

179. BAIN, D. C. 1944. Wildfire and other diseases on soybean in Louisiana. Plant Dis. Reptr. 28:656.

Records occurrence of *Pseudomonas tabaci, Diaporthe sojae* (= *D. phaseolorum* var. *sojae*) and *Sclerotium bataticola* (= *Macrophomina phaseolina*).

180. BAIN, D. C. 1944. Soybean diseases in Mississippi and Louisiana. Plant Dis. Reptr. 28:834.

Records prevalence of *Xanthomonas phaseoli* var. *sojense, Pseudomonas glycinea, P. tabaci, Sclerotium rolfsii, Cercospora sojina, Myrothecium roridum* leaf spot, *Colletotrichum* sp., *Peronospora manshurica, Diaporthe* sojae (= *D. phaseolorum* var. *sojae*).

181. BAIN, D. C. 1945. Soybean mosaic in Louisiana. *In* Diseases reported on leguminous forage and cover crops. Plant Dis. Reptr. 29:495.

Reports the occurrence of mosaic in Louisiana.

182. BAIN, D. C., and B. N. PATEL. 1972. Reaction of soybeans to *Fusarium moniliforme.* Phytopathology 62:801 (Abstr.)

In soybean culture there is a tendency toward continual cropping or rotations with grain crops such as wheat, oats, and so on. The possibility of planting in stubble and refuse of grain crops after minimum tillage has also been suggested. Since *Fusarium moniliforme* is a ubiquitous fungus on grain crops and other grasses, it was deemed important to know what effects, if any, this organism might have on soybean. Fungus inoculum was prepared by growing an isolate from diseased corn seedlings on cornmeal with perlite as carrier. Flats of both steamed and nonsteamed soils were utilized, and soybean seed (Lee 68) were planted in furrows etiher beneath or on top of the inoculum. In the controls, seed were planted directly in furrows in separate flats. Over 9,000 seed were used. Emergence in the inoculated soil was reduced by as much as 26% and was significant regardless of placement of inoculum or condition of soil, although emergence was less in nonsteamed soil. Seedlings were definitely stunted but appeared to outgrow this condition in a month or so. Root formation, in general, was not as dense as in control plants but there was no evidence of rotting. There was no seedling blight or damping-off due to *Fusarium.* Cotyledons often had lesions from which the fungus was isolated.

183. BAKAEVA, E. V., and V. I. MAZUNINA. 1972. Resistance of soybean varieties to diseases in the Alma-Ata district [in Russian]. Vestnik Sel'skokhozyais tvennoi Nauki, Alma-Ata 15(9):30–35.

Bacterial and virus diseases are the most serious in this district. *Pseudomonas* (*Xanthomonas*) *heterocea, P.* (*X.*) *phaseoli* and *P. sojae* (*P. glycinea*) causing leaf burn were isolated. Under irrigation the maturing cultivars Vysokostebel'naya 2, 1, and 3 are resistant to bacterial infection and to soybean mosaic virus.

184. BAKER, C. F. 1914. The lower fungi of the Philippine Islands. A bibliographic list chronologically arranged, and with localities and hosts. Philippine Bot. Leaflets 6, pp. 2065–2190.

Uromyces sojae (= *Phakopsora pachyrhizi*) collected by the author at Los Baños. First report for the Philippines.

185. BALASUBRAMANIAN, M. 1971. Root-knot nematodes and bacterial nodulation in soybean. Curr. Sci. 40:69–70.

Nodulation by *Rhizobium japonicum* was less in the presence of *Meloidogyne javanica, M. hapla,* and *M. incognita,* with *M. javanica* showing the greatest reduction. No effect on nodulation was found when plants were inoculated with fewer than 100 larvae of *M. javanica.*

186. BALDACCI, E. 1949. Soybean mosaic in Italy [in Italian]. Olearia 3:111–112.

187. BALDWIN, C. H., and L. A. DUCLOS. 1973. Soybean cyst nematicides research for Missouri, 1972. Univ. of Missouri, Dept. Plant Path. Misc. Pub. No. 2. 15 pp.

Twenty-eight chemicals were evaluated for control of the soybean-cyst nematode (*Heterodera glycines*) in southeast Missouri. It was concluded that nematicides have a definite place in controlling the cyst nematode. Crop rotation and use of resistant cultivars still can play a role in control programs.

188. BALDWIN, C. H., and J. D. FORD. 1974. Soybean cyst nematicide research for Missouri, 1973. Univ. of Missouri, Dept. Plant Path. Misc. Pub. 74, pp. 2–13.

Nematicides would appear to have a definite place in optimum soybean production in southeast Missouri. However, there is some indication that on soybean land infested with race 3 the soybean producer should consider a production system consisting of a 2- to 3-year rotation out of soybeans followed by a race 3 resistant soybean cultivar such as Custer, Dyer, Pickett, Pickett 71, Mack, or Forrest. If a race 3 susceptible cultivar must be grown on a field following the rotation, it is advisable to consider using a nematicide. However, where race 4 of the soybean-cyst nematode is a problem, a 2 to 3 year rotation will help reduce nematode populations, but a nematicide should be used when the field is replanted in soybeans. Continuous soybean production on any field is not recommended as this will result in development of serious weed and disease problems in addition to having a deleterious effect on soil fertility.

189. BANCROFT, J. B., and J. L. KEY. 1964. Effect of actinomycin D and ethylenediamine tetraacetic acid on the multiplication of a plant virus in etiolated soybean hypocotyls. Nature (London) 202:729–730.

Bean pod mottle virus is discussed. The results are consistent with the idea that the multiplication of a ribonucleic acid (RNA) plant virus is largely independent of the normal avenues of RNA synthesis and maintenance in plant cells.

190. BARBU, V., and I. DINESCU. 1969. [Studies on some alternariosis of cultivated plants.] Phytopath. Z. 64:344–354.

Alternaria atrans was identified on soybeans near Bucharest in Rumania.

191. BARKER, K. R., and J. N. SASSER. 1959. Biology and control of the stem nematode *Ditylenchus dipsaci.* Phytopathology 49:664–670.

Lee cultivar of soybean was susceptible to *Ditylenchus dipsaci.*

192. BARKER, K. R., and D. HUISINGH. 1969. Effects of nitrogen and *Rhizobium japonicum* on the development of *Heterodera glycines* on soybean. Phytopathology 59:111. (Abstr.)

An abstract of entry 194.

193. BARKER, K. R., and D. HUISINGH. 1970. Histological investigations of the antagonistic interaction between *Heterodera glycines* and *Rhizobium japonicum* on soybean. Phytopathology 60:1282–1283. (Abstr.)

Some races of *Heterodera glycines* inhibit nodule development on soybean. Greenhouse and histological investigations were conducted to determine histological basis for this and to determine if the timing and/or sequence of inoculation of soybean with nematode (Hg) and *Rhizobium* (R) affect this interaction. Soybean plants were inoculated with 200 crushed cysts of Hg and/or 200 mg of commercial inoculum of R, encompassing the following treatments: Hg + R added simultaneously ("0" time) to 1-week-old plants; Hg at "0" time + R at 2 days, 1 week, and 2 weeks; R at "0" time + Hg at 2 days, 1 week, and 2 weeks; R and Hg alone at above times; and noninoculated controls. Greatest inhibition of nodule development (93-100%) occurred with simultaneous inoculations. Other combination treatments gave 0 to 98% reduction of nodulation. Histological studies showed nodular tissues to be unsuitable for nematode development. Infection of the same tissues by both organisms produced hypersensitive reactions in the area around the nematode. Syncytia induced by Hg, when adjacent to developing nodules, usually failed to develop fully. Cells surrounding larvae which had penetrated nodules usually became necrotic. Although a few mature cysts developed on nodules, most infections of nodules by larvae failed to induce syncytia.

194. BARKER, K. R., P. S. LEHMAN, and D. HUISINGH. 1971. Influence of nitrogen and *Rhizobium japonicum* on the activity of *Heterodera glycines.* Nematologica 17:377–385.

Greenhouse experiments were conducted to determine the effects of source and concentration of nitrogen (N) and inoculation of soybean with *Rhizobium japonicum* (R) on the activity of *Heterodera glycines* (SCN). Application of $NaNO_3$ or NH_4NO_3 at 56 to 896 ppm N to soil or silica sand reduced nematode hatch, penetration, and "cyst" development of SCN on soybean. Inhibitory effects were positively correlated with concentration of N. Concentrations of > 112 ppm N also reduced numbers of eggs per cyst. High concentrations of NaCl also resulted in slight inhibition of nematode penetration of host roots as compared to demineralized water. Since most N concentrations used (56–225 ppm) were below those necessary to give an osmotic inhibitory effect on nematode activity and since R also interfered with nematode development, it was concluded that N has a direct inhibitory effect on SCN. Simultaneous inoculations of nodulating (nod) and nonnodulating (nonnod) isogenic lines of soybean with R and SCN (minus N), as compared to SCN alone, reduced the number of cysts developing, especially on the nod line.

195. BARKER, K. R., D. HUISINGH, and S. A. JOHNSTON. 1972. Antagonistic interaction between *Heterodera glycines* and *Rhizobium japonicum* on soybean. Phytopathology 62:1201–1205.

Greenhouse experiments and histological investigations were conducted to determine the basis for the antagonistic interaction between the soybean cyst nematode *Heterodera glycines* (SCN) and *Rhizobium japonicum* (R). Treatments included inoculation of 5- to 7-day-old Lee soybean plants with 200 crushed cysts or 20,000 eggs of SCN and/or 200 mg of commercial inoculum of R, in the following combinations: SCN with R added simultaneously and at 2–14 days later; R with SCN added simultaneously and at 2–14 days later; R or SCN alone at the above time intervals; and noninoculated controls. Greatest inhibition of nodule development occurred with simultaneous inoculations of R and race 1 of SCN. A 14-day delay in introducing SCN resulted in only slight to moderate inhibition of nodulation. Race 1 of SCN, which inhibits nodulation, penetrated nodular tissues at a much greater rate than race 4, which has little effect on nodulation. Nodular tissue, however, was unfavorable for development of larvae of either race. Most nematodes that matured in nodules were males. Histological studies also showed nodular tissues to be unsuitable for development of race 1. Infection of nodules by race 1 of SCN produced necrosis in the area around the nematode. Although a few mature cysts developed on nodules, most infections of these tissues by larvae failed to induce syncytia.

196. BARNES, E. H. 1965. Bacteria on leaf surfaces and in intercellular leaf spaces. Science N.Y. 147:1151–1152.

Ultraviolet irradiations of soybean leaves inoculated with *Xanthomonas phaseoli* var. *sojense* killed the bacterium on leaf surface but not in intercellular spaces of leaf. The bacterium has rapid death rate on drying.

197. BARNETT, N. M. 1974. Release of peroxidase from soybean hypocotyl cell walls by *Sclerotium rolfsii* culture filtrates. Canad. J. Bot. 52:265–271.

Up to 24% of the peroxidase of purified cell walls of soybean hypocotyls was released by incubation of cell walls with hydrolytic enzymes secreted by the fungus *Sclerotium rolfsii.* This estimate is based on comparison of peroxidase activity recovered in the medium with peroxidase activity in unincubated cell walls, estimated by a new assay. The peroxidase-release reaction occurs at 0 C at half the rate at 30 C. The peroxidase-release reaction occurs almost equally fast in the pH range of 3.5–8.0. The release of peroxidase from cell walls cannot be attributed solely to arabanase, polygalacturonase, or cellulase in the culture filtrate, although on Sephadex G-75 chromatography these activities overlap the peroxidase-releasing activity. Culture filtrate released less than 5% of the hydroxyproline protein of the cell walls.

198. BARRONS, K. C. 1938. Varietal differences in resistance to root-knot in economic plants. Plant Dis. Reptr. Suppl. 109:143–151.

The soybean cultivar Biloxi was almost free of galls in soil artificially inoculated with *Heterodera marioni.*

199. BATES, G. R. 1963. Botany, plant pathology and seed services. Rpt. Min. Agr. Rhodesia, Nyasaland, 1962, pp. 46–55.

Cercospora kikuchii new record on soybean in South Rhodesia.

200. BATRA, G. K., and C. W. KUHN. 1972. Inhibition of acquired resistance and polyphenol oxidase by 2-thiouracil in virus-infected soybean. Phytopathology 62:802. (Abstr.)

An abstract of entry 201.

201. BATRA, G. K., and C. W. KUHN. 1973. Inhibition of acquired resistance in cowpea chlorotic mottle virus infected hypersensitive soybean by 2-thiouracil. Virology 54:262–269.

Cowpea chlorotic mottle virus infection of hypersensitive soybean (cultivar Bragg) led to the development of acquired resistance in noninfected halves of primary leaves and in newly formed trifoliolate leaves. The level of acquired resistance was dependent on time, inoculum concentration, temperature, and host age. Application of 1 mM 2-thiouracil via roots to plants 0–24 hr. after primary inoculation abolished the development of acquired resistance. The time of application of thiouracil relative to that of primary inoculation was critical for thiouracil to inhibit acquired resistance. During the inhibition of acquired resistance, thiouracil appears to act

on an event(s) which takes place between 0 and 24 hr. after primary inoculation.

202. BATTLE, W. R., and J. L. PETERSON. 1961. Plan expanded research on soybean disease problems. New Jersey Agr. 43(3): 3–5.

Popular article describing symptoms and effects of pod and stem blight on soybean plants.

203. BAUDYS, E. 1931 Phytopathological notes VII [in Czechoslovakian, German summary]. Ochrana Rostlin 11:178–197.

A severe form of mosaic characterized by exaggerated erectness of the foliage, dwarfing, various types of deformations, spotting of leaves, sterility, and premature death of plants was observed in certain cultivars of soybean, a new crop being tried in Czechoslovakia. The disease is apparently seedborne.

204. BAWDEN, F. C., R. P. CHAUDHURI, and B. KASSANIS. 1951. Some properties of broad bean mottle virus. Ann. Appl. Biol. 38:774–784.

The virus was readily transmitted to soybean by mechanical sap inoculation, resulting in development of pinpoint necrotic spots on inoculated leaves.

205. BAWDEN, F. C. 1956. Plant viruses diseases. 3rd ed. Chronica Botanica, Waltham, Mass. 335 pp.

206. BAZAN DE SEGURA, C. 1946. [Lista de las principales enfermedades de las plantas determinadas en el Peru por el departamento de fitopatologia.] Estac. Expt. Agr. La Molina Divulg. Agr., 3, pp. 1–13.

Lists under soybean, damping-off caused by *Rhizoctonia* sp. and powdery mildew caused by *Erysiphe polygoni* and *Oidium balsamii.*

207. BAZAN DE SEGURA, C. 1947. Some fungi of Peru [in Spanish]. Lima, Peru, Estac. Expt. Agr. La Molina. Bol. 33. 28 pp.

Sclerotium rolfsii isolated from roots of diseased plants at La Molina. Macro- and micro-characteristics are given.

208. BAZAN DE SEGURA, C. 1953. Principal diseases of plants in Peru [in Spanish]. Lima, Peru, Estac. Expt. Agr. La Molina. Bol. 51.

States that seed should be treated with special fungicides for control of damping-off (*Rhizoctonia* sp.). Reports the occurrence of *Sclerotium rolfsii* and suggests control by avoiding excessive moisture and densely sown crops.

209. BAZAN DE SEGURA, C. 1959. Principal plant diseases in Peru [in Spanish]. 70 pp.

Symptoms of powdery mildew (*Erysiphe polygoni*) and control methods similar to those of powdery mildew of beans. Pathological notes on *Rhizoctonia* sp. (damping-off) and *Sclerotium rolfsii* (wilt).

210. BEAN, G. A., J. A. SCHILLINGER, and W. L. KLARMAN. 1972. Occurrence of aflatoxins and aflatoxin producing strains of *Aspergillus flavus* in soybeans. Phytopathology 62:745 (Abstr.)

Above average rainfall in Maryland during August, September, and October 1971 resulted in heavy mold growth in soybeans. Twenty-eight samples including three cultivars and 16 experimental lines collected from field plots, and four samples used in poultry feed, were assayed for aflatoxins and aflatoxin-producing strains of *Aspergillus flavus.* Aflatoxins were identified by thin layer chromatography, absorption spectra, and chick embryo bioassay. Samples with the highest percentage of moldy kernels were from an area having the greatest rainfall; however, there was low correlation between percentage moldy grain and the occurrence of aflatoxins. Aflatoxins were found in 14 samples, two of which were used in poultry feed. To isolate *Aspergillus* spp., soybeans were surface-sterilized and placed on potato-dextrose agar containing 6% NaCl and incubated at 40 C. *Aspergillus* spp. were isolated from 11 samples; five of these isolates produced aflatoxins in liquid medium. No attempt was made to identify the species of *Aspergillus* present. Of the cultivars, Wayne contained more aflatoxin than either Callard or Cutler. Roasting of soybeans did not affect aflatoxin levels.

211. BEDI, K. S. 1961. Factors affecting the viability of sclerotia of *Sclerotinia sclerotiorum* (Lib.) de Bary. Indian J. Agr. Sci. 31:236–245.

Sclerotia of the fungus are extremely resistant to exposure to: 1 hr. to 1% Cu_2SO_4 or to NaOCl, ½ hour to 0.1% $HgCl_2$ and 1% formalin and absolute alcohol, and for more than 10 min. in concentrated H_2SO_4. The resistance is due to their hard, black protective rind. Exposure to dry heat at 60–70 C for ½ to 6 hr. stimulated germination. They are resistant to prolonged freezing, freezing and thawing, and are susceptible to moist heat at 50 C for 5 min., and *Aspergillus flavus.* They do not survive when buried in compost for 1 week.

212. BEHNCKEN, G. M., and G. J. P. MC CARTHY. 1973. Peanut mottle virus in peanuts, navy beans, and soybeans. Queensland Agr. J. 99:635–637.

The mild strain of peanut mottle virus causes little damage to soybeans.

213. BELTYUKOVA, K., and O. P. LEBEDEVA. 1936. On the specialization of *Phytomonas tabaca* Wolf and Foster on certain host plants [in Russian]. A. I. Mikoyen Pan-Soviet Sci. Res. Inst. Tob. and Indian Tob. Ind., Krasnodar, Pub. 126:17–34.

By artificial inoculation, *Phytomonas tabaca* (= *Pseudomonas tabaci*) infected soybeans.

214. BENEDICT, W. G., and A. A. HILDEBRAND. 1958. The application of chromatographic methods to a study of the susceptibility of soybean to stem canker. Canad. J. Plant Sci. 38:155–163.

Chromatographic methods were used in an attempt to discover why soybeans, which are highly susceptible to infection by *Diaporthe phaseolorum* var. *caulivora* earlier in their development, become less susceptible as they grow older. Eighteen amino compounds in hydrolysates of bark of soybean stems were identified by co-chromatography with substances of known constitution. An increase in concentration of each compound was noted as stem tissue matured and became more resistant to infection. Total N of the tissues studied also increased with plant maturity.

215. BENEDICT, W. G. 1964. Studies on the effect of *Pseudomonas glycinea* on *Septoria glycines* development on foliage of the Harosoy grown under controlled environmental conditions. Canad. J. Bot. 42:1135–1142.

In growth chambers with day and night temperatures of 80 and 72 F. respectively, 100% relative humidity, and 14-hr. day length and illumination of 1100 f.c. at 16 in. above the plants, there was a marked increase in brown spot (*Septoria glycines*) in the presence of bacterial blight (*Pseudomonas glycinea*) resulting from a synergistic reaction between the two pathogens.

216. BENEDICT, W. G., and L. A. FUCIKOVSKY. 1966. *Cercospora sojina* lesions on soybeans. Canad. J. Plant Sci. 46:567–568.

In infected leaf tissues no mycelium could be detected among affected cells in early development of the lesions, where there was some collapse of tissue. Later, as necrosis developed at the center of the lesions, the mycelium was growing intercellularly and gave rise, from stomata on both leaf surfaces, to conidiophores. Soybean leaf tissue infected by *Cercospora sojina* showed cellular disorganization and accumulation of chlorophyll, starch, and ^{32}P in advance of the mycelium in a distinct plesionecrotic ring around the holonecrotic area constituting the "frog-eye" leaf spot.

217. BERGESON, G. B., and K. L. ATHOW. 1963. Vector relationship to tobacco ring spot virus (TRSV) and *Xiphinema americanum* and the importance of this vector in TRSV infection of soybean. Phytopathology 53:871. (Abstr.)

Percentage transmission of tobacco ring spot virus (TRSV) to cucumber by *Xiphinema americanum* was proportional to the vector population. *X. americanum* became viruliferous 8–24 hr. after having access to an infected plant. Viruliferous *X. americanum* stored in soil at 10 C for 49 weeks was still able to transmit TRSV to 60% of the indicator plants. A low percentage of transmission to roots of soybean was accomplished in greenhouse trials; however, the virus rarely became systemic from root infections. Control of *X. americanum* in field trials significantly reduced the number of soybean plants with TRSV-infected roots, but had no effect on the amount of foliage infection. Soybeans grown in the same field in containers filled with sterilized soil had as much TRSV foliage infection as surrounding field plants. It was concluded that an aerial insect is more responsible than *X. americanum* for TRSV dissemination in soybeans.

218. BERGESON, G. B., K. L. ATHOW, F. A. LAVIOLETTE, and M. THOMASINE. 1964. Transmission, movement, and vector relationships of tobacco ring spot virus of soybean. Phytopathology 54:723–728.

Tobacco ring spot virus (TRSV) was transmitted readily from infected cucumber or soybean to cucumber by *Xiphinema americanum,* but only rarely to soybean. Limited transmission to soybeans by thrips was demonstrated. Movement of the virus from soybean leaves to roots was rapid and common, whereas movement from roots to leaves was rare and slow. Pin-pricking soybean roots immersed in inoculum resulted in more infection than rubbing the roots with inoculum or cutting and dipping them in inoculum. TRSV transmission by the nematode occurred between 8 and 24 hr. after access to a noninfected host. *X. americanum* stored at 10 C was able to transmit the virus after 49 weeks. Controlling *X. americanum* in a soybean field significantly reduced the number of TRSV root infections, but had no effect on the number of systemic infections. Soybeans growing in the field in containers filled with sterilized soil were infected as often as surrounding field plants.

219. BERKELEY, G. H. 1947. Alfalfa mosaic on pepper in Ontario. Phytopathology 37:3. (Abstr.)

Abstract of entry 220.

220. BERKELEY, G. H. 1947. A strain of the alfalfa mosaic virus on pepper in Ontario. Phytopathology 37:781–789.

Alfalfa mosaic virus and its pepper strain and potato-calico strain all produced a mild systemic chlorotic mottle with no primary symptoms on soybean cultivar Blackeye in inoculation tests.

221. BERNARD, R. L., P. E. SMITH, M. J. KAUFMANN, and A. F. SCHMITTHENNER. 1957. Inheritance of resistance to Phytophthora root and stem rot in the soybean. Agron. J. 49:391.

Resistance is controlled by a single dominant gene.

222. BERNARD, R. L., A. H. PROBST, and L. F. WILLIAMS. 1964. New disease-resistant soybean varieties developed by backcrossing. Soybean Dig. 24:10–11.

Describes the development of the *Phytophthora mega-*

sperma var. *sojae* resistant cultivars Hawkeye 63, Harosoy 63, Clark 63, Lindarin 63, and Chippewa 63.

223. BERNARD, R. L., and C. R. CREMEENS. 1971. A gene for general resistance to downy mildew of soybeans. J. Hered. 62:359–362.

Resistance to all known races of *Peronospora manshurica* in cultivars Kanrich and Pine Dell Perfection was shown to be controlled by a single gene, Rpm. The phenotype of the heterozygote varied from intermediate to resistant, depending on genotype of host and pathogen and on environmental conditions. No effect of this resistance on seed yield was detected in heavily, naturally infested field plantings.

224. BHARGAVA, S. N., and R. N. TANDON. 1963. Vitamin requirements of three pathogenic fungi. Path. et Microbiol. 26:313–317.

An external supply of vitamins had practically no effect on growth of *Macrophomina phaseolina* but there was a slight variation in reproduction.

225. BHARGAVA, S. N. 1965. Studies on the charcoal rot of potato. Phytopath. Z. 53:35–44.

Soybean when wound-inoculated with *Macrophomina phaseoli* (= *M. phaseolina*) was susceptible to potato isolate of the fungus.

226. BHATT, V. V., and M. K. PATEL. 1955. Comparative study of species of *Xanthomonas* parasitizing leguminous plants in India. Indian Phytopath. 7:160–180.

Twelve *Xanthomonas* spp. were compared on various media. A provisional classification of the 12 species is given on the basis of carbon utilization, cultural, and biochemical responses. A host range study includes 52 plant taxa.

227. BHELWA, P. W. 1962. Seed decay, seedling blight and root rot of *Cicer arietinum* caused by *Phytophthora cryptogea.* Diss. Abstr. 23:389–390.

Phytophthora cryptogea infected Lincoln soybean roots upon artificial inoculation.

228. BIEHN, W. L. 1966 (1967). Physiology of resistance of *Glycine* and *Phaseolus* spp. to fungi. Proc. Indiana Acad. Sci. 76:203. (Abstr.)

The youngest trifoliolate leaf of soybean and etiolated hypocotyl tissue reacted hypersensitively to penetration by *Helminthosporium carbonum* and several other fungi. The reaction was accompanied by the appearance of three diazotized sulphanilic acid reaction compounds, the yields of which were increased by removal of epidermis before inoculation.

229. BIEHN, W. L., J. KUĆ, and E. B. WILLIAMS. 1968. Accumulation of phenols in resistant plant-fungi interactions. Phytopathology 58:1255–1260.

Phenols accumulated in etiolated soybean seedlings inoculated with *Helminthosporium carbonum, Monilinia fructicola, Trichoderma viride, Cercospora sojina* race 1, or *Alternaria* sp. Twenty-four to 29 hr. after inoculation with *H. carbonum,* total phenols increase in *Glycine max* SER to levels four to five times above those in inoculated, intact seedlings and noninoculated SER. The initial increase in phenols accompanies an increase in activity of phenylalanine ammonia-lyase (PAL-ase). PAL-ase activity in noninoculated *G. max* SER increases to only 20% of that in inoculated SER. Treatment of *G. max* SER with a solution of 0.1 m ethionine or 0.01 m-benzimidazole prior to inoculation with *H. carbonum* reduces PAL-ase activity 55–65%.

230. BIEHN, W. L., E. B. WILLIAMS, and J. KUĆ. 1968. Fungitoxicity of phenols accumulating in *Glycine max*-fungi interaction. Phytopathology 58:1261–1264.

A fungitoxic substance was extracted from soybean seedlings inoculated with either *Helminthosporium carbonum* or *Alternaria* sp. The germ tube growth of *H. carbonum, Alternaria* sp., *Cercospora sojina, Monilinia fructicola,* and *Trichoderma viride* was inhibited 70–90% after 24 hr. by ethyl acetate fractions from inoculated as compared with noninoculated seedlings. This inhibition was primarily due to accumulation of one of the major phenolic compounds after inoculation.

231. BILYK, L. H. 1965. Identification of soybean mosaic virus in Ukraine [in Russian, English summary]. Mykrobiol Zh. 27:35–40.

The two virus diseases found in the field were wrinkles mosaic, with properties mostly the same as those of soybean virus 1 (= soybean mosaic virus) and yellow mosaic similar to Phaseolus virus 2 (= bean yellow mosaic virus).

232. BILYK, L. H. 1965. Distribution of soybean virus in Ukraine [in Russian, English summary]. Mykrobiol. Zh. 27:40–45.

The diseases are widespread in the south and almost absent in the north. Yield is reduced up to 52% by wrinkles mosaic infection before flowering. Incidence of diseases increases considerably during growing period.

233. BILYK, L. H., and R. M. LEGUNKOVA. 1966. Electron microscope studies on the soybean mosaic virus [in Russian, English summary]. Mykrobiol. Zh. 28(4): 39–42.

A study of 123 virus particles showed them to be flexible and threadlike 750 ± 25 nm long. Dipping was found to be the quickest and most suitable method for preparing grids and enabled detection of virus which occurred at very low concentration in young plants.

234. BILYK, L. H. 1968. Intracellular inclusions of soybean mosaic virus [in Russian, English summary]. Mykrobiol. Zh. 30:145–149.

Inclusions were found in very first leaves growing after inoculating soybean plants. In form and size they resembled the nucleus, but were darker. In older leaves (1–1.5 months after inoculation), they became more loose and granular, 2–3 weeks after occurring in each cell. In plants infected through seed, inclusions were found in the epidermis of cotyledons and leaves.

235. BIRCHFIELD, W. 1954. The reproduction of *Tylenchorhynchus* sp. from sugarcane soils on different plants. Proc. Assoc. So. Agr. Workers 51:152–153. (Abstr.)

Pelican and Acadian soybeans proved to be fairly good hosts for an unnamed species of *Tylenchorhynchus.*

236. BIRCHFIELD, W., and W. J. MARTIN. 1956. Pathogenicity on sugarcane and host plant studies of a species of *Tylenchorhynchus.* Phytopathology 46:277–280.

The nematode was found to reproduce on Pelican and Acadian soybeans, which are used in sugarcane crop rotation programs.

237. BIRCHFIELD, W., and R. MOTSINGER. 1967. Soybean-cyst nematode found in Louisiana. Plant Dis. Reptr. 51:823.

Chlorotic foliage, dwarfing, and cysts were found on soybeans in Richland Parish, two miles east of Start, La. This is the first reported occurrence of the soybean-cyst nematode in Louisiana.

238. BIRCHFIELD, W., and J. PARR. 1969. Nematicidal and fungicidal effects of some soil-applied nitrogen compounds. Phytopathology 59:1018. (Abstr.)

An abstract of entry 239.

239. BIRCHFIELD, W., J. PARR, and S. SMITH. 1969. Nematicidal and fungicidal activity of potassium azide in liquid anhydrous ammonia. Plant Dis. Reptr. 53:923–926.

The nematicidal and fungicidal activity of anhydrous ammonia (NH_3) alone, and potassium azide (KN_3) formulated in anhydrous NH_3, was evaluated against the reniform nematode *Rotylenchulus reniformis* and different soil fungi. Anhydrous NH_3, and solutions of NH_3 + KN_3 ranging from 1.78 to 8.92% KN_3 (4 to 20 ppm on a soil weight basis), were formulated and applied to soil, contained in gallon cans, with a liquid fertilizer injector. Soybeans were grown for 4 weeks in a growth chamber. Effects on *R. reniformis* and fungi were determined by sampling spherical zones of soil, 5, 10, and > 10 cm around the injection point. Greater than 99% nematode control and significant reduction in the number of nematode egg masses and fungi were obtained in the three zones with NH_3 + KN_3 solutions formulated to deliver 8 to 20 ppm KN_3. Ammonia alone reduced nematode and fungal populations only in the 5 cm zone. Yield of dry matter (soybean forage) was significantly higher from NH_3 + KN_3 formulations than from NH_3 alone.

240. BIRCHFIELD, W., and L. R. BRISTER. 1969. Reaction of soybean varieties to the reniform nematode, *Rotylenchulus reniformis.* Plant Dis. Reptr. 53:999–1000.

Nineteen soybean varieties were exposed to the reniform nematode *Rotylenchulus reniformis* in naturally infested greenhouse pots. Infections on the roots and population buildup were recorded. A high degree of resistance was confirmed in Pickett and Dyer cultivars. Moderate resistance was indicated in Hardee, Coker 318, Bragg, Lee 68, Davis, and Dare. Coker 208 sustained a large amount of infection as indicated by egg masses, but maintained a relatively low soil population. All other cultivars tested were considered susceptible as indicated by large numbers of egg masses observed on the roots and by a substantial increase in the soil populations.

241. BIRCHFIELD, W., C. WILLIAMS, E. E. HARTWIG, and L. R. BRISTER. 1971. Reniform nematode resistance in soybeans. Plant Dis. Reptr. 55:1043–1045.

Resistance to the reniform nematode was found in several soybean breeding lines and cultivars. Plant reaction was classified into three groups: resistant, moderately resistant, and susceptible. Pickett, Pickett 71, D68-78, D68-80, D68-128, D68-180, and D68-185 were resistant. D68-201, D68-214, D68-216, Bragg, D64-4636, F66-1166, Ranson, Bossier, and R68-105 were susceptible. All cultivars and breeding lines resistant to soybean-cyst nematode were not resistant to reniform nematode. Separate, but probably linked, genes for resistance to these two nematodes are thought to occur.

241a. BIRCHFIELD, W., and C. WILLIAMS. 1974. Effects of nematicides and resistant soybean varieties on reniform nematode populations and soybean yields. Proc. Amer. Phytopath. Soc. 1:70 (Abstr.)

A disease of soybeans, *Glycine max,* Merr. caused by the reniform nematode *Rotylenchus reniformis* Linford and Oliveira, 1940 seriously limits soybean production in Louisiana. DBCP (1-2 dibromo-3-chloropropane) and mocap (0-ethyl S, S-dipropyl phosphorodithioate) were imposed on resistant and susceptible soybean cultivars in the field to measure the effects on reniform nematode populations and soybean yields. A summary of 5 tests at 2 locations showed that Pickett and Pickett 71 maintained lower populations of reniform nematodes than the susceptible Bragg and Lee 68 cultivars. Resistant cultivars did not allow the parasite to substantially build up the population during the growing season. Fumigation with mocap and/or DBCP significantly reduced the reniform populations in susceptible, but not in the resis-

tant, cultivars. Nontreated Pickett gave 44.7% more yield than susceptible Bragg treated with mocap. Nontreated Pickett 71 gave 18.9% more yield than susceptible Lee 68 treated with DBCP. Soil treatment with these nematicides gave no growth response to the resistant cultivars. A yield increase of about 10% was obtained by treatment of susceptible cultivars. A higher protein content was obtained with Bragg grown in non-mocap treated soil, but not the Pickett cultivar.

242. BIRD, G. W. 1973. Soybeans (*Glycine max*) lance nematode (*Hoplolaimus columbus*). Amer. Phytopath. Soc. Fungicide and Nematicide Tests, Results of 1972. 28:176.

An experiment was initiated on 10 May 1972 to evaluate five chemicals for control of *Hoplolaimus columbus* in an Oconee County, Georgia, soybean field. In June 1971, the experimental site was inoculated with *H. columbus* by placing 250 cc of *H. columbus* infested soil (150 nematodes per 100 g soil) in 4 in. deep holes in a 3 by 3 ft. grid pattern. The field was immediately planted with Bragg soybeans, broadcast in a grain drill. In the 1972 nematicide test, each treatment was replicated four times in a randomized block design containing plots 12 ft. 8 in. wide and 25 ft. long. The broadcast application of nemagon was injected immediately before planting to a depth of 6–8 in. Nemacur, furadan, and temik were applied immediately before planting in a 12–14 in. band over the row, and tilrovated to a depth of 4–6 in. All plots were planted on 10 May 1972, with four 38-in. rows of Bragg soybean seeds. Foliar applications of vydate L (0.5 lb./acre) were made 7, 14, 21, and 28 days after seeding. A fifth application of vydate L (1.0 lb./acre) was made 60 days after seeding. Soil samples for nematode analysis were taken at four intervals throughout the growing season, whereas root samples were collected on the last three sampling dates. Only the center two rows of each plot were harvested. Populations of *H. columbus* recovered from both soil and root tissue were extremely low throughout the entire growing season. Root samples taken on 12 September 1972, however, yielded significantly higher *H. columbus* populations from the nontreated plots than from those receiving any of the five chemicals. Soybean yields were significantly increased by treatment with furadan, nemacur, vydate, or nemagon. No attempt was made to evaluate the experimental chemicals for insect control.

243. BIRD, G. W., J. L. CRAWFORD, and N. E. MC GLOHON. 1973. Distribution, frequency of occurrence and population dynamics of *Rotylenchulus reniformis* in Georgia. Plant Dis. Reptr. 57:399–401.

The nematode is widely distributed in soybean fields of Georgia. The population of nematode began to decline about when the host stopped abundant production of feeder roots and continued to decline slowly throughout the winter. The rate of decline increased greatly in the spring until 45 days after seeding the new crop.

244. BISBY, G. R. 1924. The Sclerotinia disease of sunflowers and other plants. Sci. Agr. 4:381–384.

Sclerotinia (= *Whetzelinia*) *sclerotiorum* attacked soybeans in Manitoba. The morphology of the fungus is described.

245. BITANCOURT, A. A. 1934. Report on the diseases and parasitic fungi observed in the phytopathological section during the years 1931 and 1932 [in Portuguese]. São Paulo Inst. Biol., Arq. 5:185–196.

A bacterial spot assumed to be caused by *Bacterium glycineum* (= *Pseudomonas glycinea*).

246. BITANCOURT, A. A. 1938. Brazil: diseases of cultivated or useful plants, observed in the state of São Paulo. Internatl. Bull. Plant Prot. 12:49–54.

Bacterium glycineum (= *Pseudomonas glycinea*) was one of the pathogens studied at the Laboratory of Plant Pathology of the Institute of Biology, São Paulo, between 1931 and 1936.

247. BLACKIE, W. J. 1947. Department of agriculture report for the year 1946. Country Paper Fiji 19. 18 pp.

Records the occurrence of a nonspecified wilt disease on soybean.

248. BLACKMON, C. W. 1968. Soybeans and peanuts, seed and seedling diseases, several fungi. Amer. Phytopath. Soc. Fungicide and Nematicide Tests, Results of 1967. 23:123–124.

Two seed treatment tests were conducted on soybeans at the Edisto Station in 1967. One test was conducted on peanuts. Test 1 was planted on land that had never had soybeans previously. This test was planted on 1 June 1967 and stand counts taken on 6 July 1967. Bacterial inoculum was added to the treatments at recommended dosage slightly dampened and mixed thoroughly just prior to planting. Nodule counts were made on three plants from each replication. Nodules with 1 in. of the main root were counted. Tests 2 and 3 were planted 4 October 1967 and counted 20 October 1967. There were three treatments significantly higher in stand counts and one lower in test 1. Nodule development varied widely and even though the check averaged many more nodules, it was not significant. This difference was largely due to a large number of nodules developing on one of the check plants. Treatments in tests 2 and 3 in the fall showed no significant differences in stand counts.

249. BLACKMON, C. W. 1974. Soybean (*Glycine max*) lance nematode, *Hoplolaimus columbus*. Amer. Phytopath. Soc. Fungicide and Nematicide Tests, Results of 1973. 29:168.

Two experiments were conducted at Blackville, S. C. in 1973 to determine the effects of nematicides and cultural practices on soybeans in a field infested with *Hoplolaimus columbus*. Four replications in a randomized block design were used. Preplant materials, except dibromochloropropane (DBCP), were applied in a band 12–14 in. wide over the row. The materials were worked into the soil with a rotary hoe. Materials applied after emergence were side-dressed and covered with sweeps. Nematode assays were used for a total of 19 treatments. One check was not subsoiled while the second check and all chemical treatments were subsoiled. The second test consisted of a combination of various DBCP rates and methods of application along with subsoil (SS) versus nonsubsoil (non SS) treatments. All DBCP treatments except one that was injected were sprayed on (with treflan where this herbicide was used) and immediately disked in. All subsoiling was done under the row after all disking was completed. In the first test only DBCP resulted in a higher yield than the subsoil check. In the second test broadcast and disking of the fumigant increased the yield over both subsoil and nonsubsoiled checks; however, the fumigant injected in subsoil furrow gave the highest yield. There were no significant correlations among nematode counts and nematicides or yields.

250. BLACKMON, C. W., and H. L. MUSEN. 1974. Control of the Columbia (lance) nematode *Hoplolaimus columbus* on soybeans. Plant Dis. Reptr. 58:641–645.

The Columbia (lance) nematode *Hoplolaimus columbus* can cause serious losses to soybeans. This nematode was controlled by the application of nematicides. In general the fumigants gave better results than the contact nematicides, although carbofuran and phenamiphos also gave good results. Some control was achieved by row subsoiling or chiseling to a 14-in. depth where hardpan conditions existed. This practice, however, increased nematode infestation in the subsoil areas; continued chemical treatment of chiseled areas may be necessary.

251. BLOSS, H. E., and H. W. CRITTENDEN. 1962. Host parasite relationships of soybeans and *Diaporthe phaseolorum* var. *sojae*. Phytopathology 52:102–163. (Abstr.)

Plants of the soybean cultivars Clark, Ford, and Shelby were grown in the greenhouse until 8 weeks old and then transplanted to the field on June 1. On June 7, seed of the same cultivars was planted in the same field. The transplants matured from August 10–25 and the percentage of pods showing *Diaporthe phaseolorum* var. *sojae* was Ford, 52; Clark, 42; and Shelby, 37. Plants from field-sown seed matured September 18–22 and the percentage of pods showing *D. phaseolorum* var. *sojae* was: Ford, 17; Clark, 12; and Shelby, 12. Primary lesions on the pods did not appear for 30 days. When polyethylene bags were used to cover portions of Shelby plants for various periods during flowering and pod development, the presence of covers during the latter days of maturation increased the number of pods showing symptoms. Susceptibility of the 3 cultivars listed is inherited from each of 3 common ancestors: Manchu, Mandarin, and Richland. Under Delaware conditions, cultivars Bethel, Dorman, Hill, Hood, and Lee have very few pods and seeds infected with *D. phaseolorum* var. *sojae*.

252. BLOSS, H. E., and H. W. CRITTENDEN. 1966. Effect of amino acids and sugars on growth of *Diaporthe phaseolorum* var. *sojae* in liquid cultures. Phytopathology 56:92–94.

The causal organism of pod and stem blight of soybean was grown in liquid cultures with various amino acids and sugars. The fungus grew best in a salt solution that had a high phosphate:nitrate ratio. Greatest mycelial growth occurred with the amino acid DL-phenylalanine. The L-phenylalanine was utilized well but the D-phenylalanine was not. Sugars that stimulated the fungus to produce the most mycelium in culture were galactose and levulose. A Delaware isolate (from soybean seed) never had the same morphological appearance as the isolate from the American Type Culture Collection. Reactions to amino acids and sugars varied between the two isolates.

253. BOCK, H., and NGUGI. 1970. Annual report East African Agr. and For. Res. Org. 1970.

Field symptoms of soybean infected with virus were of two main types. Leaf distortion (designated as soy crinkle virus) and yellow mottle. Soy crinkle virus has some similarities to soybean mosaic virus and is associated with filamentous particles 750 nm long. Isometric particles 25–30 nm in diameter were also found in two isolates including yellow mottle.

254. BOCK, K. R. 1973. East African strains of cowpea aphid-borne mosaic virus. Ann. Appl. Biol. 74:75–83.

A strain of cowpea aphid-borne virus induced a mild systemic chlorotic mottle with faint yellow veinbanding, whereas others produced severe systemic chlorotic veinbanding, or a mild systemic chlorotic mottle. Properties of the virus are described.

255. BOCK, K. R. 1973. Peanut mottle virus in East Africa. Ann. Appl. Biol. 74:171–179.

Groundnut mottle virus is a common pathogen of soybean in East Africa.

256. BOEDIJN, K. B. 1960. The Uredinales of Indonesia. Nova Hedwigia 1:463–496.

Uromyces sojae (= *Phakopsora pachyrizi*) collected in Java, August/September 1949.

257. BOEWE, G. 1935. Soybean downy mildew in Illinois. Plant Dis. Reptr. 19:257–258.

Peronospora manshurica destroyed 10% of leaf area of

soybeans on average and the incidence was probably increased by heavy mid-June rainfall.

258. BOEWE, G. H. 1963. Host plants of charcoal rot diseases in Illinois. Plant Dis. Reptr. 47:753.

Soybean is one of hosts of *Macrophomina phaseoli* (= *M. phaseolina*).

259. BOJŇANSKY, V. (ed.) 1963. Virus diseases of plants [in Czechoslovakian]. Bratislava, Czechoslovakia. 542 pp.

Compiled by 10 Czech authors, there is a general section on all phases of virus research, followed by one in which individual diseases are discussed including the following viruses to which soybeans are mentioned as being susceptible: Abutilon infectious variegation, bean phyllody, bean yellow mosaic, bean yellow stipple, broad bean mottle mosaic, ladino clover yellow patch, lucerne mosaic, pea enation mosaic, pea streak, soybean mosaic, and tomato aspermy disease.

260. BOLTON, W. E., G. A. BOZARTH, and C. H. WALKINSHAW. 1973. Comparison of axenic and microbially contaminated soybean plants. Phytopathology 63:1501–1504.

Axenic and microbially contaminated soybean plants Lee 68 were grown within plexiglas isolators for 10 weeks. Both types of plants grew vigorously in isolators and were similar in appearance. Axenic plants flowered earlier, reached senescence first, weighed more (both fresh and dry weight), and contained 28% more protein than contaminated soybeans. Axenic soybean tissue, analyzed by optical emission spectrography and atomic absorption spectrophotometry, contained 17 elements in greater abundance than did contaminated soybean tissue.

261. BONDARTZEVA-MONTEVERDE, V. N., and N. I. VASSILEVSKI. 1940. A contribution to the biology and morphology of some species of *Ascochyta* on leguminosae [in Russian, English summary]. Akad. Nauk SSSR. Bot. Inst., Trudy Ser. II. Sporovye Rast. 4:345–376. 1938 (1940).

Morphological, cultural, and inoculation studies were made in relation to the taxonomic status of *Ascochyta sojaecola.* When 22 other legumes were inoculated, only 11 were slightly infected. Even soybean showed but slight infection when inoculated.

262. BÖNING, K. 1938. Phyllostica spot disease of soybean [in German]. Prakt. Bl. Pflanzesh. 16:168–172.

In a field of soybeans near Straubing, Bavaria, *Phyllosticta sojaecola* was observed causing a spotting of leaves and often of stems and fruits. On the leaves the spots were round or oval, 1–15 mm diameter, and dark to olive-brown with a characteristic darker margin. Stems showed brown stripes ca. 20 mm long. Spots on the pods were mostly round, brown with a reddish margin, and 1–5 mm diameter. Numerous brown, spherical pycnidia were embedded in the affected tissue, those on leaves measuring 50–120 μ and those on fruit up to 180 μ diameter; the spores averaged 5–6 by 3 μ. In pure culture the fungus developed a rapidly blackening, submerged mycelium and a dense, fluffy aerial mycelium bearing numerous microsclerotia. Sometimes larger sclerotia were also formed. The higher fruiting form of the fungus, *Pleosphaerulina sojaecola,* was not observed. Infection is seedborne, and seed disinfection together with destruction of diseased plants and harvest debris are recommended for control of the disease.

263. BÖNING, K. 1947. The brown rot of clover caused by *Thielavia basicola,* its dependence on environmental factors, and its relation to phenomena of antagonism in the Leguminosae. *In* Festival publication in honor of the 80th birthday of Prof. Dr. Otto Apple D. C., President of Biological Institute, on 19 May 1974 [in German]. Biologische Zentra. für Land und Forst. in Berlin. Dahlem. 947 pp.

Thielavia (= *Thielaviopsis*) *basicola* severely attacked soybeans.

264. BONTEA, V. 1953. Parasitic and saprophytic fungi of Rumania [in Rumanian]. 637 pp.

Reports the occurrence of *Peronospora manshurica* in Rumania.

265. BOOCK, O. J. 1950. [Dowfume W-10 no combate aos nematoides que parasitam as plantas de soja.] Rev. de Agr. (Brazil) 25(9/10):297–304.

Ethylenedibromide at 30 gal./acre gave excellent control of *Heterodera marioni* on the soybean cultivar Max Pyser. No effect on root nodulation was noted.

266. BOOSALIS, M. G. 1947. Necrosis of soybean stem and root caused by *Rhizoctonia solani.* Phytopathology 37:3. (Abstr.)

Stems and roots of soybean attacked by *Rhizoctonia solani* showed necrotic lesions in which a browning and discoloration of host cells extended for 5–8 cell layers in advance of the fungus hyphae. Hyphae were abundant on the epidermis, but never penetrated the host without first discoloring the host cells. Staling products were filtered from cultures of *Rhizoctonia.* Soybean seeds were germinated in the extracts, or the stems of aseptically grown soybean seedlings were wrapped with narrow strips of cotton soaked with the extract. Staling products alone, the diffusible substances produced by the fungus, reduced germination of soybean seed, inhibited development of secondary roots, caused necrotic lesions on stems and roots of seedlings, and killed seedlings within 7–10 days. Necrotic lesions produced by the extracts resembled lesions caused by hyphae of *Rhizoctonia,* but *Rhizoctonia* could not be isolated from them. No necrotic lesions appeared on control plants.

267. BOOSALIS, M. G. 1950. Studies on the parasitism of *Rhizoctonia solani* Kuehn on soybeans. Phytopathology 40:820–831.

Rhizoctonia solani is potential threat to soybean. Factors that may affect the incidence of *Rhizoctonia* root rot are seasonal variations of environment and physiologic races of *Rhizoctonia*. Races 16 and 1 caused most damping-off at 25–29 C. Certain isolates of the fungus can parasitize germinating seed and seedlings by acting at the host tissue through a distance. The diluted culture filtrates of strongly virulent races reduced seed germination and inhibited root development in seedlings, but filtrates from weakly virulent strains had no effect. Damping-off was considerably reduced by seed treatment with spergon or cerasan M.

268. BOOSALIS, M. G., and R. I. HAMILTON. 1957. Root and stem rot of soybean caused by *Corynespora cassiicola* (Berk. & Curt.) Wei. Plant Dis. Reptr. 41: 696–698.

Describes symptoms of circular to oval, dark reddish-brown lesions on the hypocotyl, tap roots, and larger lateral roots, ca. 2.5 mm diameter (on plants of Hawkeye and Lincoln in the 2-leaf stage), with no symptoms on cotyledons or leaves. With increasing age of the infected plants the lesions enlarge and in many cases cause girdling of the tap root and adjacent stem tissue. Lesions on the lateral roots also elongated and often coalesced to cause discoloration of the entire root. With the onset of sporulation of the pathogen, the lesions of all infected tissues changed from reddish-brown to dark violet-brown. Severely infected plants are slightly stunted with no other symptoms developing on the aerial parts of the plant. The pathogen is superficial, confined to the outer cells of the cortex. The disease is considered of little economic importance. Optimum soil temperature for disease development is 15–18 C. Morphology of the causal fungus is described.

269. BORTELS, H. 1958. On the connection between "wildfire" of tobacco caused by *Pseudomonas tabaci* (Wolf & Foster) Stevens, fluctuations in atmospheric pressure, and solar activity [in German, English summary]. Phytopath. Z. 33:403–425.

When falling atmospheric pressure (cyclonic disturbances) occurred during preparation of the culture medium, followed by rising pressure (anticyclonic developments) during and after development of the bacteria, the pathological symptoms were increased. They were reduced or suppressed altogether when reverse conditions prevailed at these times.

270. BOS, L., D. J. HAGEDORN, and L. QUANTZ. 1960. Suggested procedures for international identification of legume viruses. Tijdschr. over Plantenz. 66:328–343.

Suggests the adoption, on an international basis, of a recommended list of hosts including genus, species, and cultivar. These would be made available to researchers throughout the world, and with the same hosts prevailing throughout the world, results would be more meaningful.

271. BOS, L. 1964. Tentative list of viruses reported from naturally infected leguminous plants. Netherlands J. Plant Path. 70:161–174.

A proposal of the standardization in the use of common or vernacular virus names. Abutilon mosaic and soybean mosaic are listed as affecting soybeans.

272. BOURIQUET, G. 1946. [The diseases of cultivated plants in Madagascar.] Encyc. Mycol. (Paris) 12: 1–545.

Young soybean plants were killed by a disease, the causal organism of which was characterized by a septate mycelium 3 μ thick, present at the base of the stem, flattened pycnidia 108–150 μ in diameter, and nonseptate, cylindrical stylospores rounded at the ends and measuring 3–5.5 $\times$ 2.5 μ, is named as *Coniothyrium sojae* n. sp.

273. BOYD, O. C. 1943. Diseases in Massachusetts in 1942. Plant Dis. Reptr. 27:96–99.

Mosaic of soybean was observed.

274. BRANDES, J., and C. WETTER. 1959. Classification of elongated plant viruses on the basis of particle morphology. Virology 8:99–115.

Describes soybean mosaic virus: normal length 750 mμ; shape, flexible threads; diameter 12–13 mμ; transmission by aphids and sap; thermal inactivation point 50–60 C.

275. BRAUN, A. C. 1955. A study on the mode of action of the wildfire toxin. Phytopathology 45:659–664.

Physiological and chemical studies indicate that the toxin association with the wildfire disease of tobacco is a structural analogue of methionine that owes its biological activity in one and perhaps all susceptible plant species to its behavior as a naturally occurring antimetabolite of that essential amino acid.

276. BRETZ, T. W. 1943. Surveys in Iowa and Missouri. Plant Dis. Reptr. 27:377–380.

Reports the occurrence of *Pseudomonas glycinea* and *Sclerotium bataticola* (= *Macrophomina phaseolina*) in Missouri and *P. glycinea, Xanthomonas phaseoli* var. *sojense, Diaporthe sojae* (= *D. phaseolorum* var. *sojae*) and mosaic virus in Iowa.

277. BRETZ, T. W. 1944. Damping-off and bacterial blight of soybeans in east-central Missouri. Plant Dis. Reptr. 28:657.

Records the occurrence of *Pseudomonas glycinea* and damping-off.

278. BRETZ, T. W. 1944. Diseases reported on soybeans. Plant Dis. Reptr. 28:712.

Records the occurrence of *Rhizoctonia* sp., *Peronospora manshurica,* Pythium and Fusarium wilts, *Macrophomina phaseoli* (= *M. phaseolina*), *Pseudomonas glycinea* and *Xanthomonas phaseoli* var. *sojense.*

279. BRETZ, T. W. 1944. Diseases observed on soybeans in Missouri. Plant Dis. Reptr. 28:832–834.

Records the occurrence and prevalence of mosaic virus, bud blight virus, *Cercospora* sp., *Peronospora manshurica, Sclerotium bataticola* (= *Macrophomina phaseolina*), *Pseudomonas glycinea, Xanthomonas phaseoli* var. *sojense, Diaporthe sojae* (= *D. phaseolorum* var. *sojae*).

280. BRETZ, T. W. 1944. Diseases in Missouri. Plant Dis. Reptr. 28:891.

Records the occurrence of bacterial leaf spot, *Xanthomonas phaseoli* var. *sojense, Pseudomonas glycinea,* bud blight (tobacco ring spot virus), mosaic virus, and *Peronospora manshurica.*

281. BRETZ, T. W. 1944. Plant disease surveys in northeastern United States in 1943. Plant Dis. Reptr. Suppl. 147:217–224.

Records occurrence and prevalence of diseases caused by the following pathogens: *Diaporthe sojae* (= *D. phaseolorum* var. *sojae*), *Glomerella glycines, Peronospora manshurica,* and *Pseudomonas glycinea.*

282. BRETZ, T. W. 1944. Summary of plant diseases observed in Missouri during 1943. Plant Dis. Reptr. Suppl. 148:294–302.

Records occurrence of *Diaporthe sojae* (= *D. phaseolorum* var. *sojae*), *Peronospora manshurica, Pseudomonas glycinea, Xanthomonas phaseoli* var. *sojense, Macrophomina phaseolina,* and bud blight (virus ?).

283. BRIDGE, M. A., and W. L. KLARMAN. 1970. Ultraviolet induction of an antifungal chemical in soybeans. Phytopathology 60:1013. (Abstr.)

Detached cotyledons from 7- to 9-day-old Harosoy 63 soybeans were exposed to ultraviolet irradiation (= 2536 Å) at a distance of 4 in. for 20 min. Other cotyledons were inoculated with the soybean pathogen *Phytophthora megasperma* var. *sojae,* by inserting mycelium in holes punched in the cotyledons. All cotyledons were incubated in closed petri dishes containing 7 ml distilled water for 2 days in darkness under room conditions. Controls were similar nontreated cotyledons. Ether extracts from each group of cotyledons were chromatographed with thin layer chromatography (TLC) and assayed by spraying the developing TLC plates with spores of *Cladosporium cucumerinum* suspended in a nutrient solution. Extracts of fungal-inoculated and ultraviolet-treated cotyledons produced spots of inhibition at R_f 0.8, but no inhibition resulted from control extracts. Fungal- and ultraviolet-stimulated extracts exhibited absorption spectra maxima at 289 mμ and 294 mμ, and a minimum at 253 mμ. In cotyledons incubated in darkness following ultraviolet exposure, the surface layer of cells developed a bronze color within 2 days. Bronzing of cotyledons and production of inhibitor were reduced when cotyledons were incubated in strong visible light after ultraviolet exposure.

284. BRIDGE, M. A., and W. L. KLARMAN. 1973. Soybean phytoalexin, hydroxyphaseollin, induced by ultraviolet irradiation. Phytopathology 63:606–609.

The phytoalexin, hydroxyphaseollin (HP), was detected in soybean hypocotyl 12 hr. after ultraviolet irradiation (a max = 253 nm) when plants were maintained in darkness. Maximal concentrations of HP occurred 96 hr. after irradiation and relatively high levels were still present after 216 hr. Hypocotyls from irradiated plants maintained 12 hr. in darkness and subsequently in light contained approximately half as much HP as hypocotyls from plants kept in constant darkness following irradiation. Hypocotyls from plants placed in light immediately after irradiation contained almost no HP. The concentrations of HP remained high in irradiated plants placed in darkness for 48 hr. and subsequently placed in light for 48 hr. When genetically susceptible plants were irradiated they became less susceptible to the soybean pathogen, *Phytophthora megasperma* var. *sojae.*

285. BRIDGMON, G. H., and J. C. WALKER. 1952. Gladiolus as a virus reservoir. Phytopathology 42:65–70.

First report of natural infection of gladiolus by tobacco ring spot virus.

286. BRIEN, R. M. 1932. Host range of *Sclerotinia sclerotiorum* in New Zealand. New Zealand J. Agr. 44: 127–129.

Sclerotinia sclerotiorum attacks soybean stems, on which it produces round, black sclerotia.

287. BRIM, C. A., and J. P. ROSS. 1963. Soybean cyst nematode resistant strain developed. Res. and Farming (Autumn 1963) pp. 12–13.

A popular article in which the first adapted strain of soybean with high resistance to the soybean-cyst nematode is reported. The strain has been designated NC 55 and made available to research workers.

288. BRIM, C. A., and J. P. ROSS. 1964. A cyst nematode resistant soybean strain. Soybean Dig. 24(1):17.

NC 55, a black-seeded soybean line developed at the North Carolina Agricultural Experiment Station, is resistant to *Heterodera glycines.* NC 55 resulted from the third backcross of Lee to the original cross of Lee × Peking. Seed was increased in winter 1962 in Puerto Rico for 1963 field trials.

289. BRIM, C. A., and J. P. ROSS. 1966. Relative resistance of Pickett soybean to various strains of *Heterodera glycines*. Phytopathology 56:451–454.

The new soybean cultivar Pickett was found resistant to strains of the soybean-cyst nematode (*Heterodera glycines*) in Missouri, North Carolina, and Tennessee, but not in Virginia. Resistance of Pickett resides in failure of female cyst nematodes to develop and reproduce in roots. On noninfested soil at three locations, Pickett did not yield significantly less than Lee, the most widely grown cultivar in the Southeast. Yield advantage of resistant lines similar to Pickett compared to Lee on infested soil depends on the magnitude of the nematode population.

290. BRINKERHOFF, L. A., G. FISK, R. A. KORTSEN, and D. SWIFT. 1954. Further studies on the effect of chemical seed treatments on nodulations of legumes. Plant Dis. Reptr. 38:393–400.

Nodulation of soybean and cowpea grown in noninfested soil was reduced or nearly eliminated by seed treatment with phygon, arasan, or spergon prior to inoculation with *Rhizobium*. In the field the reduction was more pronounced in 1951 following a drought, than in an excellent 1950 season. The dry method of inoculation was less effective than wet, regardless of seed treatment. Seed treatment had no appreciable effect on nodulation in naturally infested soil.

290a. BRISTOW, P. R., and T. D. WYLLIE. 1974. Enumeration of *Macrophomina phaseolina* propagules in field soils. Proc. Amer. Phytopath. Soc. 1:124. (Abstr.)

A technique was developed to quantitatively estimate low inoculum densities of *Macrophomina phaseolina* in naturally infested soil. A tared 2 mm thick plastic template with 127 uniformly spaced 1 mm diameter holes was placed in direct contact with CMR agar, a selective medium developed by Meyer et al. (Phytopath. 63:613–620, 1973), in a petri dish. A weighed amount (ca. 100 mg) of finely ground air-dried soil was spread over the template with a cover slip. The exact amount of soil deposited on the agar was calculated from the weight of soil remaining on the template. The approximately 50 mg of soil deposited on the agar provided a lower limit of 20 propagules/g for this quantitative technique. Characteristic colonies were recognized after 7 days' incubation at 33 C. The inoculum density in a Missouri field planted to soybeans in 1973 ranged from 37–156 propagules/g air-dried soil, indicating that the technique was applicable for determining populations of the pathogen in field soils.

291. BRITON-JONES, H. R., and R. E. D. BAKER. 1934. Notes on some other fungus diseases in Trinidad. Trop. Agr. (Trinidad) 11:67–68.

Soybeans were attacked by *Sclerotium rolfsii*.

292. BROWN, E. 1964. Effect of oxygen concentration on Pythium seed rot of soybean. Phytopathology 54:889. (Abstr.)

An abstract of entry 294.

293. BROWN, G. E., and B. W. KENNEDY. 1965. Pythium pre-emergence damping-off of soybean in Minnesota. Plant Dis. Reptr. 49:646–647.

Pythium seed rot may occur during prolonged rainy periods following planting and seedling rot may occur at any stages prior to emergence. It is indicated that radicles may be attacked prior to eruption through seed coat or shortly after eruption. At more advanced stage of host growth, hypocotyls are attacked at the crook or at the growing tip. Seedling may die when crook is invaded. Seedling attacked at root tip at late stages of pre-emergence growth may survive by forming secondary roots. Hyphae of *Pythium* were observed in cells throughout the radicle. Direct penetration occurred through epidermis, spread intracellularly within the cortex and endodermis and ultimately invaded the stele. The fungus was not restricted to any anatomical region. *P. ultimum* and *P. ultimum*-types were most pathogenic.

294. BROWN, G. E., and B. W. KENNEDY. 1966. Effect of oxygen concentration on Pythium seed rot of soybean. Phytopathology 56:407–411.

Growth of *Pythium* was significantly reduced at an O_2 concentration of 1.3% but not at 4% or above. Pre-emergence growth of Chippewa soybean seedlings was significantly retarded at 4% O_2 with successively better growth in atmospheres containing 8, 11.5, and 21% O_2. In tests with 4% and 8% O_2, all seedlings were infected with *Pythium*. A 24 hr. period of low O_2 (4%), starting 14 hr. after planting, enhanced seed rot over that obtained at 21% O_2 continuously. Substances detected with $AgNO_3$ were exuded from the hilum region of germinating Chippewa soybean seedlings and later from the hypocotyl neck area and root tip. Increased production of sucrose, fructose, galactose, glucose, and substances reactive with ninhydrin occurred in exudates collected from seedlings germinated at low O_2 concentrations, and these exudates supported best growth of *Pythium*. Bacterial contamination favored increased sugar production in exudates collected at all O_2 concentrations.

295. BROWN, J. G. 1948. Root-knot in Arizona. Univ. Arizona Agr. Expt. Sta. Bull. 212. 40 pp.

A general article which describes root-knot symptoms, control, host range, histopathology, and control of root-knot (*Heterodera marioni*) on various crops including soybean.

296. BROWN, W., F. T. BROOKS, and F. C. BAWDEN. 1948. A discussion on the physiology of resistance to disease in plants. Proc. Roy. Soc. London. Ser. B., Biol. Sci. 135:171–195.

297. BRUDNAIA, A. A., and E. D. IAKIMOVICH. 1938. Principle measures for protection of soybeans from pests and diseases [in Russian]. Moscow Vsesoiuz. Nauch.-Issled. Inst. Severnogo Zernovogo Khoz. I Zernobob. Kul'ture, Trudy 3:116–135.

298. BRUNDZA, K. 1937. Report of the phytopathological section of the plant protection station in Lithuania for the year 1935 [in Lithuanian, English summary]. Kaunas. 32 pp.

Pseudomonas (= *Xanthomonas*) *phaseoli* var. *sojense* occurred on soybeans.

299. BRUNER, S. C. 1921. A preliminary list of the plant diseases of economic importance for Cuba [in Spanish]. Cuba Estac. Expt. Agron., Informe 1918/19, 1919/20 (5):723–763.

A bacterial disease, evidently attributed to *Bacterium glycineum,* has been observed in seed plantings at the Agronomy Experiment Station of Cuba, causing considerable damage.

300. BRUNT, A. A., and R. H. KENTEN. 1973. Cowpea mild mottle, a newly recognized virus infecting cowpea (*Vigna unguiculata*) in Ghana. Ann. Appl. Biol. 74: 67–74.

The cowpea mild mottle virus induced conspicuous systemic vein mosaic and general leaf chlorosis within 14–21 days after inoculation of Chippewa and Kanrich soybeans. Infected plants occasionally showed apical necrosis. Properties of the virus are described.

301. BRYANT, W. E., and T. D. WYLLIE. 1968. Effect of temperatures and variety on nematode development and gall production on soybeans infected with *Meloidogyne incognita acrita.* Phytopathology 58:1045. (Abstr.)

The responses of four soybean cultivars, Scott, Clark, Hill, and Anderson, to infection by *Meloidogyne incognita acrita* were compared in growth chambers. Hill and Anderson developed fewer and smaller galls and supported nematode development less well than Scott and Clark. All cultivars responded similarly to change in temperatures with respect to their support of nematode development and gall production. The rate of nematode maturation increased with increase in temperature. The least, intermediate, and greatest development of the nematode were under temperature regimes of 20 C day and 10 C night, 25 C day and 15 C night, and 30 C day and 20 C night, respectively. Greater numbers of galls developed on plants growing at the 30 C day and 20 C night temperatures than under the two lower temperature regimes. Based on the criteria of galling response and nematode development, Hill and Anderson were considerably more resistant than Scott and Clark to *M. incognita acrita.*

302. BRYCE, P. I. 1918. Injurious fungi of Ste. Anne de Bellevue, 1917. Ann. Rpt. Quebec Soc. Prot. Plants (1917/18) 10:49–51.

303. BUCHWALD, N. F. 1947. Sclerotiniaceae of Denmark. A floristic-systematic survey of the sclerotial cup fungi found in Denmark. Part I. *Ciboria, Rustroemia, Myriosclerotinia* n.g., and *Sclerotinia* [in Danish]. Friesia 3:235–330.

A specimen of *Sclerotinia sclerotiorum* was collected September 1941. Nomenclature, culture, and history of the fungus in Denmark are discussed.

304. BUITRAGO, G. L. A., M. R. MONTES, and S. H. OROZCO. 1970. [Determination of the physiologic races of *Peronospora manshurica* in the Cauca Valley and test for varietal resistance to downy mildew of soybean]. Acta Agron. Palmira 20:1–7.

The presence of race 19 and a new race provisionally called race 24 was established in Cauca Valley, Colombia. The highest yields were found in the susceptible cultivar Hale 3. In the field, incidence was highest at pod formation. The 86 cultivars tested ranged from immune to highly susceptible. Variations in severity of attack on a given cultivar were determined by temperature, relative humidity, and the presence of race 24.

305. BURGWITZ, G. K. 1925. Bacterial blight and spotting of soybean (*Glycine hispida* Maxim) [in Russian, German summary]. Morbi Plantarum Leningrad 14:38–41.

Soybean seedlings raised at Leningrad (where the plant was never cultivated before) from seeds received from Mongolia developed a severe leaf spot, named as bacterial blight, caused by *Bacterium glycineum* (= *Pseudomonas glycinea*). It suggests that the disease must be present in Mongolia and was introduced to Russia with imported seeds.

306. BURKHOLDER, W. H. 1930. The bacterial diseases of the bean. A comparative study. Cornell Agr. Expt. Sta. Mem. 127.

Bacterium vignae var. *leguminophila* and *B. viridiflava* infected the pods of soybean in inoculation experiments.

307. BURNS, N. C., and D. C. NORTON. 1970. Influence of soil pH on nematode populations associated with soybeans. J. Parasit. 56:43. (Abstr.)

An abstract of entry 308.

308. BURNS, N. C. 1971. Soil pH effects on nematode populations associated with soybeans. J. Nematol. 3:238–245.

Amsoy soybeans were grown for 2 months in nonsterilized Jackson silt loam amended to pH 4, 6, and 8. Nematodes were extracted biweekly from soil and roots. The greatest numbers of *Pratylenchus alleni* colonized soy-

bean roots at pH 6. *Hoplolaimus galeatus* and members of the Tylenchinae-Psilenchinae survived best at pH 6, while numbers of the Dorylaimoidea were greatest at both pH 6 and 8. The nonstylet nematodes were recovered in greater numbers from pH 8 soil. K, Mn, and phenols were highest in soybean plants grown in pH 4 soil, the pH at which there were the fewest nematodes. A thicker suberized outer layer of root tissue occurred in plants grown at pH 4.

309. BUSHKOVA, L. N. 1966. [Specialization of the causal agent of bacterial rot of beans.] Biol. Nauki 9: 202–205.

Soybeans were susceptible to *Pseudomonas fabae*.

310. BUSTILLO, B. A. 1972. Influence of *Rotylenchulus reniformis* infection on replication of cowpea chlorotic mottle virus in Davis soybean. J. Nematol. 4:220–221. (Abstr.)

Spectrophotometric analyses of purified virus preparations and local lesion assays of clarified sap indicated that *Rotylenchulus reniformis* infection increases replication of cowpea chlorotic mottle virus (CCMV) in soybean, Davis. Soybeans were planted in a sterile soil mix in 15.3 cm pots, inoculated with water suspensions of *R. reniformis* larvae, and immediately covered with a layer of soil. Nematode inoculation densities of the three experiments were 1,150, 2,680, and 2,900 larvae/seed. Twelve days after seeding the plants were mechanically inoculated with CCMV. After 4 or 5 days, all leaves were harvested for virus purification and assay. CCMV was purified by chloroform-butanol buffer extraction and by ultracentrifugation. No visible differences were apparent between the symptoms on plants inoculated with the virus vs. nematode-virus. Plant heights, root weights, and leaf weights were not significantly different at time of harvest. Spectrophotometric analyses of the purified virus preparations indicated that virus nucleoprotein was increased 15–73% in the nematode-infected plants. Local lesion assays of the clarified sap followed the same trend, indicating that virus nucleoprotein was increased as much as 43% when nematodes were present.

311. BUTLER, E. J. 1918. Fungi and disease in plants. Thacker, Spink and Co., Calcutta, India. 457 pp.

Includes a description of the downy mildew of soybean and its causal fungus which was said to agree with *Peronospora trifoliorum*.

312. BUTLER, E. J., and G. R. BISBY. 1931. The fungi of India. Imp. Counc. Agr. Res. India Sci. Mono. 1. 44 pp.

Lists *Peronospora trifoliorum, Phyllosticta glycines* (= *P. sojaecola*), and *Septoria sojae* (= *S. sojina*) on soybean. *Uromyces sojae* (= *Phakopsora pachyrhizi*) previously reported on soybean proved to be *Uromyces mucunae* on Mucuna.

313. CALDWELL, B. E., C. A. BRIM, and J. P. ROSS. 1960. Inheritance of resistance to the soybean-cyst nematode, *Heterodera glycines*. Agron. J. 52:635–636.

A study was conducted in an attempt to determine the inheritance of resistance to the soybean-cyst nematode, *Heterodera glycines*. Included in the study were resistant and susceptible cultivars, strains, and plant introductions crossed in various combinations. F_1 plants from resistant × susceptible matings were susceptible to the cyst nematode, while F_1 plants from resistant × resistant matings were resistant. Data from the F_2 generation of resistant × susceptible crosses fitted a genetic model of three independently inherited recessive genes for resistance. Satisfactory agreement of observed with an expected ratio of seven susceptible to one resistant was also obtained from classifying testcross plants. The necessity for classifying advanced generations to verify further the genetic hypothesis is discussed.

314. CALHOUN, S. 1947. Hail damage to soybeans. Soybean Dig. 7(9):14–15.

A report of the work by Kalton and others. (See entries 1035 and 1036.)

315. CALVERT, O. H., L. F. WILLIAMS, and M. D. WHITEHEAD. 1960. Frozen lima bean agar for culture and storage of *Phytophthora sojae*. Phytopathology 50: 136–137.

A medium for culture of *Phytophthora sojae* consists of 18% frozen lima beans, 1.5–2.0% agar, 1 liter distilled H_2O. Blend beans in water in Waring blender, add agar, and autoclave for 30 min. Tube or pour into flasks without filtering and reautoclave. Keep agar out of light to prevent yellowing.

316. CALVINO, E. M. 1942. [Virosi bellosa e mosaico internervale in diverse varieta di soja.] Costa Azzura Agr. Flor., Sanremo 22:85–87.

317. CANER, J., K. SILBERSCHMIDT, and E. FLORES. 1969. Occurrence of cowpea mosaic virus in São Paulo state [in Portuguese]. Biologico 35:13–16.

First report of the occurrence of cowpea mosaic virus in Brazil. The virus also infects soybeans. Symptoms are described.

318. CAPOOR, S. P., and P. M. VARMA. 1956. Studies on a mosaic disease of *Vigna cylindrica* Skeels. Indian J. Agr. Sci. 26:95–103.

Catjang mosaic virus inoculated mechanically to soybean produces a faint mosaic and discoloration of the leaves which are reduced in size.

319. CAPPELLINI, R. A. 1959. Brown spot of soybeans in New Jersey. Plant Dis. Reptr. 43:287.

Septoria glycines is recorded. The causal fungus is seedborne. Late occurrence of disease has no effect on yield.

320. CARVALHO, J. C. 1954. Soybean and its soil enemies [in Portuguese, English summary]. Rev. Inst. Adolfo Lutz 14:45–52.

Four species of root-knot nematode have been found attacking soybeans in São Paulo: *Meloidogyne javanica, M. arenaria, M. incognita,* and *M. hapla.* The soybean cultivar La 41-1219, which is considered to be susceptible in the southern United States, was slightly resistant to *M. arenaria* in Campinas. The cultivar Abura was badly attacked by *M. javanica, M. arenaria,* and *M. incognita* in different districts. In Terra Roxa, soybeans were attacked by *M. hapla.*

321. CARVALHO, J. C. 1957. *Rotylenchus elisensis* nova especie associada com raizes de soja [in Portuguese, English summary]. Rev. Inst. Adolfo Lutz 17:43–46.

Rotylenchus elisensis n.sp. is described and illustrated. It is unique in possessing a short, tapering, arcuate tail in each sex. Details of the junction of esophagus and intestine were not clear, the bursa does not reach the tail tip, the vulva is at 73%, and the gonads are relatively little developed. These data suggest affinities in *Rotylenchulus* though the position of the orifice of the dorsal esophageal gland is against this.

322. CARVALHO, J. C. 1959. *Helicotylenchus elisensis* no. comb. (Nematoda: Tylenchidae) [in Portuguese, English summary]. Arch. Inst. Biol. São Paulo 26:45–48.

Rotylenchus elisensis is synonymized with *Helicotylenchus elisensis.*

323. CARVER, G. W. 1901. Some *Cercosporae* of Macon County, Alabama. Tuskegee Norm. and Indus. Inst. Expt. Sta. Bull. 4. 8 pp.

First report of *Cercospora canescens* on soybean in United States.

324. CASTANO, J. J., and M. F. KERNKAMP. 1956. The influence of certain plant nutrients on infection of soybeans by *Rhizoctonia solani.* Phytopathology 46:326–328.

Soybeans were inoculated with *Rhizoctonia solani* and grown in sand culture with deficiencies of Ca, Mn, Fe, S, N, P, or K. A deficiency of any of these elements except K increased severity of infection. In tests under other than deficiency conditions, the degree of infection was not influenced by the different levels of Ca and Mn used. The cortical tissues of Ca-deficient plants were poorly organized, with thin cell walls, poorly developed middle lamellae, and large intercellular spaces. This condition apparently allowed easy penetration and invasion by hyphae of the pathogen.

325. CASTELLANI, E. 1948. [Viruses of soybean.] Olearia 2:838–844.

Notes based on the literature are given on symptoms, manner of spread, and control of soybean mosaic virus, bean yellow mosaic virus, and "curvatura apicale" (tobacco ring spot virus). Soybean mosaic is widespread in Italy. Affected plants harboured *Doralis* (= *Aphid*) *fabae,* which may possibly be a vector. Tobacco ring spot virus on soybean has not yet been found in Italy.

326. CASTELLANI, E. 1950. [On some virus diseases of forage legumes observed in the province of Florence.] Notiz. Malatt. Piante 12:1–8.

Soybean mosaic was widely prevalent in experimental soybean plants in Florence, Italy.

327. CAVINESS, C. E., and H. J. WALTERS. 1971. Effect of Phytophthora rot on yield and chemical composition of soybean seed. Crop Sci. 11:83–84.

Three soybean cultivars (Hill, Hood, and Lee) susceptible to Phytophthora rot caused by *Phytophthora megasperma* var. *sojae* and a resistant near-isogenic line of each cultivar were evaluated for 3 years at 3 locations in Arkansas. Near-isogenic lines were derived by crossing each cultivar to Arksoy, which is resistant to this disease, and making 5 backcrosses to the recurrent parent. Yields of these resistant lines did not differ significantly from those produced by susceptible cultivars at Stuttgart where damage from Phytophthora rot was negligible. At locations where damage from this disease was moderately severe, yields of Hood and Lee generally were significantly lower than their resistant near-isogenic lines, with yields of Hood reduced more than Lee. Yields of Hill generally were reduced less than other cultivars. Cultivars damaged by Phytophthora rot produced seed with lower protein and higher oil content than near-isogenic lines resistant to this disease. Protein and oil content of seed of susceptible cultivars and their resistant near-isogenic lines did not differ significantly at the location where damage from this disease was negligible.

328. CELINO, M. S. 1936. Diseases of cotton in the Philippines: I. Sclerotium stem rot with notes on other diseases. Philipp. Agr. 25:302–320.

Soybean strain of *Sclerotium rolfsii* appeared to be the same as the cotton strain.

329. CHAKRAVARTI, B. P., C. LEBEN, and G. C. DAFT. 1972. Numbers and antagonistic properties of bacteria from buds of field-grown soybean plants. Canad. J. Microbiol. 18:696–698.

Terminal buds yielded 10^6–10^7 bacteria/g (wet weight) comprising a variety of cultural types, some of which were antagonistic in vitro to *Pseudomonas glycinea* and other bacterial pathogens.

330. CHAMBERLAIN, D. W. 1948. Soybean disease investigations in 1947. Soybean Dig. 8:18.

1947 presented many reversals in relative importance of soybean diseases. In Illinois, brown stem rot, which was present only in the roots and basal stems, and bud blight

caused little damage, whereas *Septoria glycines* became most destructive. Bacterial blight became more important than bacterial pustule. Wildfire was not observed. Rhizoctonia rot and Alternaria leaf spot were unusually widespread. Of 1,100 introductions, three highly resistant to bacterial blight were singled out as promising.

331. CHAMBERLAIN, D. W., and W. B. ALLINGTON. 1948. Effect of temperature on brown stem rot of soybeans. Phytopathology 38:4. (Abstr.)

The effect of temperature on development of brown stem rot of soybeans and on the causal organism was studied in the greenhouse and in the field. Air temperature appeared to be the important factor in disease development. When artificially inoculated plants were maintained at 15, 21, and 27 C, internal stem browning appeared within 3 weeks in plants at 15 C, while plants at the higher temperatures showed little or no evidence of the disease. When these latter plants were transferred to the 15 C chamber they developed symptoms within 2 to 3 weeks. These results are correlated with outdoor temperatures in 1945, 1946, and 1947 and the development of brown stem rot in these years. In culture, the optimum temperature for growth of the fungus was 22–24 C, for germination of conidia 21–25 C, for spore production, 15–20 C.

332. CHAMBERLAIN, D. W. 1951. Resistance to bacterial blight in soybeans. Phytopathology 41:6 (Abstr.)

In 1947, approximately 1,200 cultivars and introductions of soybeans were tested for reaction to bacterial blight (*Pseudomonas glycinea*). Three highly resistant introductions were selected for study in the greenhouse. They were tested by water-soaking the leaves with the bacterial suspension by means of an atomizer connected to a compressed-air line. The susceptible cultivars Illini and Bansei, were used as controls. The resistant introductions developed only necrotic spots, whereas the susceptible cultivars developed spreading, translucent, water-soaked areas within 5–7 days after inoculation. Highly diluted inoculum induced slight chlorosis on the resistant introductions; the susceptible cultivars, under the same conditions, developed typical blight symptoms. Leaf samples, taken at daily intervals from inoculated leaves of susceptible and resistant plants, were crushed in sterile H_2O and plated on potato-dextrose agar to determine comparative bacterial populations. There was little difference in rate of multiplication of *P. glycinea* in the leaves of resistant and susceptible soybeans until 4 days after inoculation. Subsequently, bacterial populations increased rapidly in the susceptible leaves in contrast with a slow, limited increase in the resistant leaves.

333. CHAMBERLAIN, D. W. 1951. Sclerotinia stem rot of soybeans. Plant Dis. Reptr. 35:490–491.

Seed germination reduced to 66% in soil infested with fungus, at 25 C. Stem rot symptoms are described.

334. CHAMBERLAIN, D. W. 1952. A halo-producing strain of *Pseudomonas glycinea*. Phytopathology 42:299–300.

A strain of *Pseudomonas glycinea* differs from other isolates only in its ability to produce halos on young leaves. Small-sized halos at high temperatures soon change to lesions typical of common blight. Under certain conditions, both halo-forming and nonhalo-forming isolates produce appreciable amounts of yellowing around the margins of lesions. The symptomatology of bacterial blight cannot be distinguished from that of bacterial pustule on the basis of marginal yellowing.

335. CHAMBERLAIN, D. W. 1953. Disease reaction to inoculum dilution in bacterial blight of soybean. Phytopathology 43:468. (Abstr.)

The relationship between dilution of inoculum and disease reaction of soybean was studied in the greenhouse with *Pseudomonas glycinea* as the test organism. Inoculations were made with an atomizer, water-soaking the leaves with the bacterial suspension. The following concentrations of bacteria per ml sterile water were used: 8,000,000; 800,000; 80,000; 8,000; and 800. There was a direct relationship between concentration of bacteria and the number of typical lesions induced on resistant and susceptible plants. Concentrations between 800,000 and 80,000 cells per ml gave the most pronounced differential between resistant and susceptible cultivars. Although the 8,000,000 concentration gave excellent differential reaction in the field, it occasionally induced too severe a reaction on greenhouse-grown cultivars of proved field resistance. Reducing the bacterial load in the inoculum appears to compensate for this difficulty in blight-resistance testing work in the greenhouse.

336. CHAMBERLAIN, D. W., and D. F. MC ALISTER. 1954. Factors affecting the development of brown stem rot of soybean. Phytopathology 44:4–6.

Brown stem rot progressed more rapidly in plants beyond the pod-filling stage than in younger plants irrespective of temperature. High day temperature (32 C) had much the same inhibiting effect on fungus growth as high constant temperature. The rate of water flow in soybean stems was inversely related to the degree of browning in the vascular system.

337. CHAMBERLAIN, D. W. 1956. Pathogenicity of *Pseudomonas tabaci* on soybeans and tobacco. Phytopathology 46:51–52.

Cross-inoculations with 6 isolates of *Pseudomonas tabaci* from tobacco and 6 from soybeans indicated strain differences in pathogenicity for either host. Tobacco isolates were consistently more pathogenic on tobacco than were the soybean isolates. On soybeans, the reverse was true, but differences were less pronounced. The erratic behavior of all isolates on soybeans indicated that *P. tabaci*

is a less virulent primary parasite on soybeans than on tobacco.

338. CHAMBERLAIN, D. W. 1956. Methods of inoculation for wildfire of soybean and the effect of bacterial pustule on wildfire development. Phytopathology 46: 96–98.

A comparison of six different methods of inoculation showed that the wildfire disease of soybeans developed best when associated with the bacterial pustule disease. This was true whether the wildfire inoculum was sprayed over pustule-affected leaves, or whether *Pseudomonas tabaci* and *Xanthomonas phaseoli* var. *sojense* were introduced simultaneously into the leaf by water-soaking. Previous infection with the bacterial blight organism *P. glycinea* also favored wildfire infection. Water-soaking the healthy leaf with wildfire inoculum alone resulted in erratic infection. Wounding was an ineffective method of inducing infection. Healthy leaves sprayed lightly with inoculum without water-soaking developed no infection.

339. CHAMBERLAIN, D. W. 1957. Maintaining bacterial organisms in soybean leaves. Plant Dis. Reptr. 41: 1039–1040.

Pseudomonas glycinea, the soybean bacterial blight organism, has been maintained in leaves at 5–7 C for 7 years without loss of viability or virulence. Infected leaves from the field or greenhouse are equally effective when used directly as inoculum. It is easier, however, to isolate the organism from leaves grown in the greenhouse because they are virtually free of contaminating organisms. Cold storage likewise proved to be an effective method for preserving *P. tabaci* in soybean leaves. Virulent cultures of the organism were isolated after 3½ years storage at 5–7 C. Neither of these organisms lived beyond 2 months in leaves stored at laboratory temperature (24–35 C).

340. CHAMBERLAIN, D. W. 1961. Reduction in water flow in soybean stems by a metabolite of *Cephalosporium gregatum.* Phytopathology 51:863–865.

A study was undertaken to determine whether a metabolite of *Cephalosporium gregatum* could be responsible for reducing water flow in the vessels of soybean stems. An extract from diseased stems was forced through sections of healthy soybean stems, which then were tested for any change in the rate of water flow. Passage of the diseased-stem extract through the vessels reduced water flow to 10–34% of normal. The active agent was not removed by a Seitz filter and was still effective when the extract was diluted 1:5 and 1:10 with H_2O; it was not destroyed or changed by autoclaving for 60 min. at 15 psi.

341. CHAMBERLAIN, D. W. 1962. Reaction of resistant and susceptible soybeans to *Xanthomonas phaseoli* var. *sojense.* Plant. Dis. Reptr. 46:707–709.

Dilutions between 1–1,000 and 1–10,000 of a standard suspension (about 800,000,000 cells/ml) of *Xanthomonas phaseoli* var. *sojense* were satisfactory for evaluating bacterial pustule reaction of greenhouse plants. The organism multiplied in leaves of the resistant CNS cultivar but at a lower rate than in those of the susceptible Lincoln. In leaf extracts, there was no consistent difference in rates of multiplication of the organism in extracts from resistant and susceptible leaves. Grafting resistant scions to susceptible roots and vice versa did not affect susceptibility of the leaves. Bacteria-free culture extract did not stimulate pustule formation in susceptible soybean leaves. Passage of the organism through leaves of the resistant cultivar had no apparent effect on its pathogenicity.

342. CHAMBERLAIN, D. W. 1963. Brown stem rot of soybeans. Soybean Dig. 23:16.

A popular article describing symptoms and rotation as the only control measure of the disease.

343. CHAMBERLAIN, D. W. 1963. Spot and stop soybean diseases. II. The leaves and seeds. Crops and Soils 15(8):16–17, 20.

A popular article, describing symptoms and control measures of bacterial blight, bacterial pustule, wildfire (cultivars Clark 63, Scott, Hill, Hood, Lee, Hampton, and Hardee listed as resistant to these diseases), brown spot, downy mildew, frog-eye leaf spot, (cultivars Kent, Dorman, Lee, Ogden, and Roanoke listed as resistant), purple seed stain, mosaic, yellow mosaic, and bud blight.

344. CHAMBERLAIN, D. W., and J. W. GERDEMANN. 1966. Heat-induced susceptibility of soybeans to *Phytophthora megasperma* var. *sojae, Phytophthora cactorum,* and *Helminthosporium sativum.* Phytopathology 56:70–73.

Resistant Harosoy 63 soybeans became as susceptible to *Phytophthora megasperma* var. *sojae* when subjected to heat treatment in the range of 43–45 C as nonheated Harosoy (susceptible). Heat-treated Harosoy plants were more susceptible than nonheated Harosoy plants. After treatment at 44 C, soybeans became susceptible to two nonpathogens of soybeans, *P. cactorum* and *Helminthosporium sativum.* Normal resistance was recovered 3 days after heat treatment. Neither heat-treated nor nonheated plants were susceptible to the saprophytes *Trichoderma viride, Aspergillus niger,* and *Chaetomium globosum.* Heat-treated plants inoculated with *P. cactorum* produced less phytoalexin than did nonheated plants inoculated with this species.

345. CHAMBERLAIN, D. W., and J. D. PAXTON. 1968. Protection of soybean plants by phytoalexin. Phytopathology 58:1349–1350.

Harosoy soybean plants, susceptible to *Phytophthora megasperma* var. *sojae,* were protected against infection

by this pathogen by a phytoalexin produced in resistant Harosoy 63 plants. The phytoalexin was transported from the resistant to the susceptible plant by a string wick in sufficient quantity to protect the susceptible plant. Wick tips containing phytoalexin prevented infection when placed in hypocotyl wounds in susceptible plants with the pathogen. Two chromatogram fractions of the material from the wick tips also protected susceptible plants from *P. megasperma* var. *sojae.* A third fraction containing fungitoxic material appeared to decompose rapidly in the soybean plant and provided little or no protection.

346. CHAMBERLAIN, D. W. 1970. Temperature ranges inducing susceptibility to *Phytophthora megasperma* var. *sojae* in resistant soybean. Phytopathology 60:293–294.

Recovery of resistance to *Phytophthora megasperma* var. *sojae* in heat-treated Harosoy 63 soybean plants began between 12 and 16 hr. after treatment and was completed between 20 and 24 hr. after treatment. Loss of resistance was irreversible in plants treated for 2 min. at 50 and 55 C. Heat-treated plants stored at 10 C did not recover resistance in 48 hr. Stem tissues 2 cm above the treated area were susceptible; tissues 3 cm above the treated areas were resistant.

347. CHAMBERLAIN, D. W. 1972. Heat-induced susceptibility to nonpathogens and cross-protection against *Phytophthora megasperma* var. *sojae* in soybeans. Phytopathology 62:645–646.

Of 17 species of fungi, all nonpathogens of soybean, four (*Ceratocystis fimbriata, Fusarium moniliforme, Gibberella zeae,* and *Helminthosporium turcicum*) killed heat-treated Harosoy soybean plants. These four also cross-protected Harosoy plants against *Phytophthora megasperma* var. *sojae.* Ten of the nonpathogens caused no infection on heat-treated plants; 6 of the 10 gave good cross-protection against *P. megasperma* var. *sojae.* Apparently, resistance to nonpathogens in soybean is not governed by a single mechanism.

348. CHAMBERLAIN, D. W., and L. E. GRAY. 1974. Germination, seed treatment and microorganisms in soybean seed produced in Illinois. Plant Dis. Reptr. 58:50–54.

Germination rates for soybean seed harvested in Illinois in 1972 were highest in the northern and lowest in the southern part of the state. *Diaporthe phaseolorum* var. *sojae* was the predominant organism isolated from the seed. Low rates of germination were associated with high percentages of *Diaporthe*-infected seeds. Seed treatment with captan or thiram improved germination by 60% however. The other fungi isolated from seeds were *Macrophomina phaseolina, Cercospora kikuchii, Aspergillus flavus, Fusarium* spp., *Alternaria* spp., and *Penicillium* spp.

349. CHAMBERLAIN, E. E. 1939. Pea-streak (Pisum virus 3). New Zealand J. Sci. Tech. 20A:365–381.

The virus is readily sap-transmitted to soybean.

350. CHAMBERS, A. Y., and J. M. EPPS. 1965. Comparative suitability of hosts for reproduction of *Heterodera glycines.* Phytopathology 55:497. (Abstr.)

Reproduction rates of the soybean-cyst nematode, *Heterodera glycines,* were compared on 11 cultivated and weed hosts in three replicated greenhouse experiments. Pots containing 2-week-old plants were inoculated with eggs and larvae from 100 crushed cysts and grown for 2 months. Examination of inoculated roots and soil for white females and cysts showed that hemp sesbania, *Sesbania exaltata,* supported about three times as much reproduction per g of root as soybean Lee. Kobe lespedeza, *Lespedeza striata,* maintained over seven times as much reproduction as soybean in one experiment and reproduction comparable to that on soybean in two experiments. Korean lespedeza, *L. stipulacea* Rowan, and henbit, *Lamium amplexicaule,* supported reproduction equal to soybean in the three and two experiments, respectively, in which each was included. Reproduction on azuki bean, *Phaseolus angularis,* and mung bean, *P. aureus* Kiloga, was comparable to that on soybean in two experiments and significantly poorer in one experiment. Snap bean, *P. vulgaris* Contender, was equal to soybean for reproduction in one experiment and significantly poorer in two experiments. Sericea lespedeza, *L. cuneata;* hairy vetch, *Vicia villosa;* and white lupine, *Lupinus albus* were poor hosts in all three experiments.

351. CHAMBERS, A. Y., and J. M. EPPS. 1966. Nature of resistance in soybean varieties and breeding lines resistant to *Heterodera glycines.* Phytopathology 56:873. (Abstr.)

An abstract of entry 352.

352. CHAMBERS, A. Y., and J. M. EPPS. 1967. Nature of soybean resistance to *Heterodera glycines.* Plant Dis. Reptr. 51:771–774.

Tops and stems of soybean plants of susceptible cultivars Lee and Hill, resistant cultivar Peking, resistant strain NC 55, and resistant D63-7320 and D63-7327 were rooted and the roots inoculated with larvae of the soybean-cyst nematode, *Heterodera glycines.* The adventitious roots from tops and stems from all susceptible plants became heavily infected with white females; none was observed on adventitious roots of resistant plants. Scions of resistant Peking and NC 55 soybeans were grafted to susceptible Lee rootstocks, and Lee scions were grafted to Peking and NC 55 rootstocks. Roots of grafted plants with susceptible scions and resistant rootstocks were free of white females, while roots of grafted plants with resistant scions and susceptible rootstocks became heavily infected. The results suggest that the factor(s) for resistance or susceptibility to *H. glycines* is not synthesized in

one part of the soybean plant and translocated to other parts, but is probably genetically inherent in tops, stems, and roots of resistant plants.

353. CHAMBERS, A. Y. 1968. Soybean, seedling diseases, seed- and soil-borne organisms. Amer. Phytopath. Soc. Fungicide and Nematicide Tests, Results of 1967. 23:124.

The plot area was located on land that was grown in cotton in 1964–1966 and had a history of seedling disease injury. Seeds of Hood cultivar with good germination but only moderate vigor were slurry-treated with enough water for coverage with each of the fungicides evaluated except arasan 50-red and panogen PX which were applied as planter hopper-box dust treatments. Two-row, 6 × 20 ft. plots replicated four times in a randomized block design were planted on April 17. Seeding rate was approximately 30 lb./acre. Stand was counted, measured, and indexed according to length on May 23. Twenty plants were lifted at random in each plot, rated according to seedling disease injury to roots and lower stems, measured, and weighed on June 8. Plots were harvested, and yields were recorded on October 24.

Significantly greater number of plants survived in plots planted with seed treated with all fungicides, except chemagro 4497, than in the plots planted with nontreated seed. Survival was significantly greater in plots treated with terraclor super X than in the other plots. Arasan 50-red plus demosan, morton EP-277, and panogen 15 also gave excellent plant survival. All treatments reduced disease injury. Terraclor super X, morton EP-277, and panogen 15 also gave excellent plant survival. All treatments reduced skipiness significantly except chemagro 4497 which had more skipiness than no treatment. All fungicides reduced disease injury to surviving plants. Terraclor super X, morton EP-277, and arasan 50-red plus demosan were indicated to be more effective than most of the other treatments. Plants were taller in plots treated with arasan 50-red plus demosan, morton EP-277, and vitavax than in the nontreated plots and were significantly shorter in plots of chemagro 4497. Plant weights varied considerably in plots of the different treatments but were not significantly greater or less in the treated plots than in the nontreated plots. Plots of arasan 50-red plus demosan and uniroyal F-849 outyielded the nontreated plots. Plots of all treatments outyielded plots of chemagro 4497 except those of difolatan. Considerable phytotoxicity was noted in plots of chemagro 4497, panogen PX, and panogen 15; the amount of stunting is indicated in the data on plant height and weight. Several of the fungicides gave excellent seedling disease control, and some gave increased yields of soybeans. These results indicate that seed treatments may be of special value on soybean seeds of reduced vigor that are planted early.

354. CHAMBERS, A. Y. 1970. Soybean, seedling diseases (seed- and soil-borne organisms). Amer. Phytopath. Soc. Fungicide and Nematicide Tests, Results of 1969. 25:126.

Seed of Hood cultivar with 80% germination and moderate vigor were treated in enough H_2O for coverage with each of the fungicides evaluated except arasan 50-red, panogen PX, and ceresan M-DB which were applied as planter hopper-box dust treatments. Two-row, 6 × 20 ft. plots of each seed treatment replicated four times in a randomized block design were planted April 22. The plot was located on land grown in soybeans in 1967 and 1968. Seeding rate was approximately 45 lb./acre. Cool, moist conditions followed planting. On June 5, stand counts of surviving and dead soybean plants in each plot were made; and skips were counted, measured, and indexed according to length. Twenty plants lifted at random in each plot were weighed and measured. Plots were harvested on November 7–12.

Significantly greater numbers of plants emerged and survived in plots planted with seed treated with all fungicides except vitavax, ceresan M-DB, and ceresan L than in the plots planted with untreated seed. Emergence and survival were significantly reduced below that in the nontreated plots in plots planted with seed treated with ceresan M-DB and ceresan L, which appeared to be phytotoxic to the soybeans. Skipiness was significantly greater in plots receiving the ceresan M-DB and ceresan L treatments. Other treatments did not reduce skipiness when compared to nontreated plots. Plants in plots receiving ceresan L were slightly stunted while those in plots of ceresan M-DB were greatly stunted. Yields were significantly reduced in the ceresan M-DB plots. Eight of the fungicides, including the new materials except vitavax, gave excellent seedling disease control. Soybean seed appears to be sensitive to ceresan M-DB and ceresan L. Results indicate that seed treatment may be of value if seeds are of only fair quality and if the weather conditions are favorable for seedling disease development.

355. CHAND, J. N., and D. S. VERMA. 1968. Occurrence of new Alternaria leaf spot of clusterbean (*Cyamopsis tetragonoloba*) in India. Plant Dis. Reptr. 52: 145–147.

Alternaria tenuissima causes leaf spots of soybean in India.

356. CHANDRASRIKUL, A. 1962. A preliminary host list of plant diseases in Thailand. Thailand Dept. Agr. Tech. Bull. 6. 23 pp.

Fusarium wilt, *Sclerotium rolfsii* (root rot), and *Macrosporium* sp. (leaf spot) on soybeans.

357. CHATTOPADHYAY, S. B., and C. R. DAS. 1956. The occurrence of some virus diseases of agricultural crop plants in West Bengal. Bot. Soc. Bengal Bull. 9:42–45. 1955 (1956).

Wherever soybeans are cultivated in the plains regions

they become badly infected with a "mosaic" disease. In the hills, the crop does not suffer from any virus disease.

358. CHAUBE, H. S., N. SINGH, and R. S. SINGH. 1971. Systemic fungicidal activity of benlate in soybean. Indian J. Mycol. Plant Path. 1:99–102.

It appears that this compound, used as a seed treatment against *Cercospora kikuchii,* is absorbed by the seed, retained for several weeks, and translocated to the cotyledonary leaves of the seedling but not to the true leaves.

359. CHAUDHURI, R. P. 1950. Studies on two aphid-transmitted viruses of leguminous crops. Ann. Appl. Biol. 37:342–354.

Pea enation mosaic virus is apparently, but not definitely, identified on soybean. Pea mosaic virus did not infect soybean.

360. CHEE, K. H. 1972/1973. Diseases of crop plants caused by bacteria. Malayan Agri. 11:1–4.

Bacterial spot of soybean caused by *Xanthomonas phaseoli* is reported from Malaya for the first time.

361. CHENG, Y. W., and K. L. CHAN. 1968. The breeding of rust resistant soybean Tainung 3 [in Chinese, English summary]. J. Taiwan Agr. Res. 17:30–34.

Tainung 3 soybean was selected from F7 plants to the cross Nung-shih H-11 × PI 200492 in 1963. Prior to release, Tainung 3 was identified by the number Nung-shih 63-11. It is adapted to the whole island in the spring and winter crops. Tainung 3 is characterized by purple flowers, brown pubescence, large seed size (18–20 g/100 seeds), yellow seed coats, and brown hila. Tainung 3 outyielded Tai-ta-Kaohsiung 5 (check variety, 1,800–2,500 kg/ha in both spring and winter crops), 17–52% in the winter crop and 15–178% in the spring crop. The more severe the rust disease, the greater the difference found in the yield. It has similar maturity with Tai-ta-Kaohsiung 5. Tainung 3 is resistant to lodging and to soybean rust (*Phakopsora pachyrhizi*) that caused leaf wilting at early infections, and defoliations at later stages. The only undesirable character is the cracking of seed coat. Tainung 3 was named in December 1967 and was to be released in 1968. Taiwan Agricultural Research Institute is responsible for maintenance of breeder seeds.

362. CHEO, C. C., and S. L. TSAI. 1959. Virus diseases of legumes (annual report, 1957–1958) [in Chinese, English summary]. Acta Phytopath. Sinica 5(1):7–11.

Seed transmission of soybean rugose mosaic is reported. A yellowing of alfalfa was sap-transmissible to soybean.

363. CHEREWICH, W. J. 1941. Rhizoctonia root rot of sweet clover. Phytopathology 31:673–674.

A species of *Rhizoctonia,* probably *R. solani,* from sweet clover is pathogenic to soybean.

364. CHESTER, K. S., and W. E. COOPER. 1944. A lethal virus of guar (*Cyamopsis psoraloide* D.C.). Phytopathology 34:998. (Abstr.)

The virus from *Cyamopsis psoraloide* D.C. infects soybeans by inoculation.

365. CHI, C. C., and E. W. HANSON. 1965. In vitro effects of *Streptomyces rimosus* on some soil inhabiting fungi. Plant Dis. Reptr. 49:159–163.

Germination of soybean seed soaked 12 hr. in culture filtrate of *Streptomyces rimosus,* were not affected, but the seedlings were stunted and chlorotic at cotyledonary stage. Most seedlings later recovered.

366. CHIBA AGRICULTURAL EXPERIMENT STATION. 1938. Experiment on the prevention of purplespot of soybean [in Japanese]. J. Plant Prot. (Tokyo) 25:311.

Seed treatment with mercuric chloride 1:5,000 for 30 min. greatly increased germination percentage.

367. CHITWOOD, B. G., and W. BIRCHFIELD. 1956. Nematodes, their kinds and characteristics. State Plant Bd. Florida 2. 9 pp.

Refers to control of the soybean-cyst nematode by crop rotation. Several hosts of the cyst nematode are mentioned.

368. CHIU, W. F. 1955. Purple stain fungus (*Cercospora kikuchii* Matsumoto et Tomoyasu) of soybean seed [in Chinese, English summary]. Acta Phytopath. Sinica 1:191–204.

In North China, infection of soybean seed by *Cercospora kikuchii* caused both purple stain and dark-brown and greenish black specks. In culture on a synthetic agar medium, growth of the fungus was increased when $FeCl_3$ or $MgSO_4$ were removed. Peptone (1%) in place of KNO_3 reduced growth on agar but gave highest yield of mycelium in a liquid medium. NO_3 was a better source of N than NO_2 or NH_4. On agar, growth was best at 28 C, sporulation at 20–24 C, and the greenish black pigment was usually produced at 32 C. In liquid cultures, depending upon the medium employed, three pigments were produced: red-purple, yellow, and greenish olive.

369. CHOMCHALOW, S., and B. NORMAN. 1972. A comparative study on the effectiveness of local and introduced *Rhizobium* strains on "S.J.2" soybean. Thai J. Agr. Sci. 5:135–142.

By modified Leonard's jar assembly, 7 strains of introduced *Rhizobium japonicum* received from the United States and from Australia were inoculated to S.J.2 soybean seeds in an attempt to compare the effectiveness of these introduced strains which have been known to be effective in inducing nodulation on foreign soybean cultivars. A locally isolated strain from Chai Nat (CN1) was

also tested. It was found that strain CB 1795 (Aust.) was the best and strains US 38, US 110, and CB 1809 were equally effective on the bases of nodulation, dry weight per plant, and nitrogen uptake per plant. Strain CN 1 was effective in nodulation but its ability to fix atmospheric nitrogen was inferior to that of some of the introduced strains.

370. CHONA, B. L., and R. L. MUNJAL. 1956. Notes on miscellaneous Indian fungi — III. Indian Phytopath. 9:53–66.

Mycosphaerella phaseoli is a new species (reported on *Phaseolus aureus* only) of which the conidial stage description agrees with *Cercospora kikuchii* Matsu. and Tomoyasu which has been recorded on soybeans. Although no organic connection has been established between the ascigerous and conidial stages, the presence of both in the same spots and also the fact that some perithecia were often seen bearing conidiophores resembling those of *C. kikuchii* suggests that these are two stages of the same fungus. Morphological characters of perithecial and conidial stages was described.

371. CHONA, B. L., and R. L. MUNJAL. 1957. *Cicinnobolis cesati* DeBary: hyperparasite of powdery mildews in India. Indian Phytopath. 9:98–105.

Cicinnobolis cesati is reported as parasitizing *Oidium* sp. on *Glycine javanica.* Mildew spots, mostly single, rarely two or more together, were on both leaf surfaces, though more commonly on the upper. Mildew patches gradually became dark brown due to the appearance of the hyperparasite. Specimens were collected in Madura district, South India, at 8,000 feet. Pycnidia and pycnospores of hyperparasite are described.

372. CHOU, L. G., and A. F. SCHMITTHENNER. 1973. Effect of *Rhizobium japonicum* and *Endogone mosseae* on virulence of *Pythium ultimum* and *Phytophthora megasperma* var. *sojae* on soybeans. 2nd Internatl. Cong. Plant Path. Abstrs. 0662.

A double styrofoam cup system was used in this study. One cup with a nylon tulle bottom was filled with perlite-vermiculite, autoclaved muck-soil mixture (1:1:1:1) (v/v), and nested in a second cup. *Rhizobium japonicum* or *Endogone mosseae* or the combination, were mixed thoroughly with the soil when used. Two-week-old V-8 juice agar cultures of *Pythium ultimum* and *P. megasperma* var. *sojae* (*Pms*) races 1 and 3 were then added either as a layer 7 cm below the seeds at planting time or between the bottom of the inner and outer cups 2 weeks after planting. All combinations of *Endogone, Rhizobium, Pythium,* and *Phytophthora* were tested using Harosoy 63 soybeans. The soil was kept near saturation during the 35-day period. Soybeans infected with *Pms* race 3 alone or in combination with *Pythium* had significantly lower mean plant height and shoot dry weights than soybeans infected by *Pythium* and/or *Pms* race 1. *Rhizobium* and *Endogone* had no effect on the virulence of *Pythium* and *Pms* in this system. However, soybeans infected by *Pms* race 3 developed fewer root nodules than those infected by *Pythium* or *Pms* race 1 or the control.

373. CHOU, L. G., and A. F. SCHMITTHENNER. 1974. Effect of *Rhizobium japonicum* and *Endogone mosseae* on soybean root rot caused by *Pythium ultimum* and *Phytophthora megasperma* var. *sojae*. Plant Dis. Reptr. 58:221–225.

A double styrofoam cup system was used to expose Harosoy 63 soybean roots to all possible combinations of *Rhizobium japonicum, Endogone mosseae, Phytophthora megasperma* var. *sojae* races 1(*Pms*1) and 3(*Pms*3), and *Pythium ultimum.* No soybeans were killed by *P. ultimum* alone or in combination with *Pms*1. *P. ultimum* plus *Pms*3 resulted in more plants killed than *Pms*3 alone. Soybeans infected by *Pms*3 alone or in combination with *P. ultimum* had significantly lower mean plant height and lower shoot dry weights than soybeans infected by *P. ultimum* and/or *Pms*1. *Pms*3-infected soybeans had lower dry weights in soil without *Rhizobium* and *Endogone* than in most treatments with *Rhizobium* and *Endogone.* The latter two organisms had no other effects on the mean plant height and dry weights of soybean infected by *Pythium* and *Phytophthora* in this system. Fewer plants were killed by *Pms*3 in *Endogone*-treated soil than in soil without *Endogone.* Soybeans infected by *Pms*3 developed fewer root nodules than those infected by *P. ultimum* or *Pms*1 or the control.

374. CHRISTENSEN, C. M., and C. E. DORWORTH. 1966. Influence of moisture content, temperature, and time on invasion of soybeans by storage fungi. Phytopathology 56:412–418.

The two-stage air, oven method and drying whole beans for 116 hr. at 105 C gave moisture contents in very close agreement with one another. The theoretically accurate Karl Fischer method was costly in apparatus and time, and is considered to have limited utility for routine determinations of moisture content of grains and seeds. The Motomco meter gave results in very close agreement with those of oven drying. Soybeans with moisture contents below 13.0% were invaded by *Aspergillus halophilicus* and *A. restrictus* and to some extent by *A. repens.* Invasion of soybeans by storage fungi was accompanied by increases in fat acidity values. No invasion of soybeans by storage fungi occurred at 5 C, even when the beans had a moisture content of 14.1%. When beans of Acme and Chippewa of different moisture content were mixed together and held, those of Acme eventually had the lower moisture content, even when their moisture content at time of mixing was the higher of the two. It seems probable that the present moisture limits for grades 1 and 2 soybeans are too high.

375. CHRISTENSEN, C. M. 1967. Increase in invasion

by storage fungi and in fat acidity values of commercial lots of soybeans stored at moisture content of 13.0–14.0%. Phytopathology 57:622–624.

None of 8 samples of soybeans, each representative of a different carload lot, increased appreciably in invasion by storage fungi or in fat acidity value when stored at moisture content of approximately 13 and 14% at 5 C for 150–170 days. Samples stored at 13% moisture content and 5 C increased slightly in fat acidity value and in invasion by storage fungi in 480–500 days. Those stored at the same original moisture content and at 25 C increased appreciably in invasion by storage fungi and in fat acidity value, the increases being greater at the higher moisture content and at the longer storage period.

376. CHRISTIE, J. R. 1952. Some new nematode species of critical importance to Florida growers. Soil and Crop Sci. Soc. Florida Proc. 12:30–39.

This paper gives information on the sting, stubbyroot, dagger, and root-knot species of nematodes and lists some of their host crops. Soybeans are mentioned as being severely injured by the sting nematode, *Belonolaimus gracilis.*

377. CHRISTIE, J. R. 1959. Plant nematodes — their bionomics and control. Agr. Expt. Sta. Univ. Florida, Gainesville. H. and W. B. Drew Co. 256 pp.

There are a number of references to nematodes of soybeans. Suggestions for control as well as use of resistant cultivars are discussed.

378. CHU, C. L., and C. C. CHEN. 1968. Study of bacterial blight of soybean caused by *Pseudomonas glycinea* Coerper [in Chinese, English summary]. J. Taiwan Agr. Res. 17:54–64.

Bacterial blight was more serious in cool, wet weather, especially in spring in cultivated field and *Pseudomonas glycinea* survived in diseased leaves from one growing season to the next. Optimum temperature for pathogen was 28–30 C minimum 5 C and maximum 40 C and optimum pH 6–7.4. Cultivars Sanko and TuKH #5 were less susceptible than Tainung #2 and 64–91.

379. CHU, C. R. 1941. Observations on plant diseases in Sikiang [in Chinese]. *In* Report on the scientific expedition to the Province of Sikiang, pp. 93–115. Chinese Nat. Sci. Soc.

380. CHU, H. T., and C. CHUANG-YANG. 1961. Investigation on soybean diseases [in Chinese, English summary]. Taiwan Sugar Expt. Sta. Rpt. 25:11–25.

Diseases of soybeans prevalent in the sugarcane-soybean interplanted fields of Taiwan are: *Alternaria* sp. (brown spot); *Cercospora kikuchii* (purple seed stain); *Fusarium oxysporum* f. *tracheiphilum* (Fusarium pod rot); *Peronospora manshurica; Sclerotium rolfsii* (sclerotial blight); leaf-crinkle virus; and mosaic virus. Four of the five most destructive diseases in these fields are: *Glomerella glycines* (anthracnose), infection exceeds 60% and infected plants die when half-grown; *Phakopsora sojae* (= *P. pachyrhizi*), against which six fungicides and five combinations of fungicides were tested; *Xanthomonas phaseoli* var. *sojense* (bacterial pustule); and rosette-type virus which may cause up to 20% infection and plants may produce almost no seed. Effects of *Meloidogyne javanica* on yields of 10 soybean cultivars was studied.

381. CHUNG, B. K. 1969. An investigation of pre-penetration structure by soybean anthracnose fungus, *Glomerella glycines* [English summary]. J. Plant Prot. Korea 8:25–28.

To determine the effect of contactor in forming appressorial structure of *Glomerella glycines,* this experiment used several contactors such as cover glass, cellophane, vinyl, and oil paper. When cover glass was placed on a drop of conidial suspension of the fungus which was incubated on water agar for 12 hr., 67.7% of appressoria resulted, whereas no appressorial structure was found in the control. Vinyl was the best physical contactor and cellophane, cover glass, and oil paper were next, in that order. Effects of temperature, time, and relative humidity on the formation of appressoria of *Glomerella glycines* were similar to each optimum growth range of temperature and relative humidity 25–30 C and 70–100%, respectively. In addition, maximum appressorial formation occurred in the conidial suspension incubated on soybean leaves for 36 hr. No appressorium was found at above 35 C, below R. H. 70% and 5 hours' incubation.

382. CHUNG, H. W., H. S. CHUNG, and B. L. CHUNG. 1964. Studies on pathogenicity of wheat scab fungus (*Gibbrella zeae*) to various crop seedlings. J. Plant Prot. Korea 3:21–25.

Soybeans were susceptible to *Gibbrella zeae* in inoculation tests.

383. CHUPP, C. 1954. A monograph of the fungus genus *Cercospora.* Ithaca, N.Y. 667 pp.

Cercospora glycines is described on *Glycine clandestina,* with a full mycological description of the fungus, known only from the type locality, Victoria, Australia. On *Glycine max,* a full mycological description is given of *Cercospora cruenta, C. kikuchii,* and *C. sojina.*

384. CIFERRI, R. 1927. [Mycological and phytopathological notes. Serie II. No. 5] Riv. Patol. Veg. 17:209–294.

In Italy soybeans were affected by an *Ascochyta* morphologically identical with *A. pisi* except that 20% of the spores were uniseptate.

385. CLARK, S. A., A. M. SHEPHERD, and A. KEMPTON. 1973. Spicule structure in some *Heterodera* spp. Nematologica 19:242–247.

Observations with the scanning electron microscope on spicule structure of 11 species of *Heterodera* confirmed that the spicule tips in species of *Heterodera* were basically bifid whereas those of *H.* (*Globodera*) had single points. In all the species two small pores were located close to the tip of each spicule. Sections through the spicules of *H. rostochiensis,* observed with the transmission electron microscope, showed that they contained a large nerve which tapered towards the spicule tip, where two dendritic elements were associated with the pores. The shape of the spicule blades, which have incurved, interlocking wings, ensures an enclosed, tubular structure through which sperm can be transferred when the spicules are protruded and inserted into the female reproductive tract. In mating, the spicules may have a sensory function.

386. CLARKE, R. G., and G. E. WILDE. 1970. Association of the green stink bug and the yeast-spot disease organism of soybeans. I. Length of retention, effect of molting, isolation from feces and saliva. J. Econ. Ent. 63:200–204.

Acrosternum hilare was fed a suspension of the yeast-spot disease organism, *Nematospora coryli,* in sugar water and on *N. coryli*-inoculated soybeans in the laboratory to obtain infested insects. The suspension method proved the more reliable, infesting 100% of the specimens, compared with 73% fed on inoculated soybeans. Insects consistently retained *N. coryli* in the heads for 90 days, and less frequently in their thoraxes and abdomens. Insects lost *N. coryli* from their heads during molting, and it was isolated from their feces but not from salivary secretions.

387. CLARKE, R. G., and G. E. WILDE. 1970. Association of the green stink bug and the yeast-spot disease organism of soybeans. II. Frequency of transmission to soybeans, transmission from insect to insect, isolation from field populations. J. Econ. Ent. 63:355–357.

Eighteen *Acrosternum hilare* adults were infested in the laboratory with *Nematospora coryli* Peglion, the yeast-spot disease organism of soybeans, and transmitted *N. coryli* to soybeans in 60% of their feedings. Six insects transmitted in more than 70% of their feedings; one, 79%. Noninfested green stink bug adults became infested with *N. coryli* in the field by feeding on berries of dogwood, *Cornus drummondi* Meyer, and soybeans previously fed on by laboratory-infested green stink bugs. Of adult *A. hilare* field collected during the summer of 1968 in Kansas, 23% were infested with *N. coryli.*

388. CLARKE, R. G., and G. E. WILDE. 1971. Association of the green stink bug and the yeast-spot disease organism of soybeans. III. Effect on soybean quality. J. Econ. Ent. 64:222–223.

Damage to soybean seed by *Acrosternum hilare* was not increased significantly by the presence of *Nematospora coryli.* Soybean seeds fed on late in their development by *Acrosternum hilare* displayed no significant damage to oil and protein content 9 and 18 months after harvest. Damage was not increased significantly in the presence of *Nematospora coryli,* the yeast-spot disease organism. Bean weight was affected by stink bug feeding alone and, in one test, also in the presence of *N. coryli.*

389. CLAYTON, C. C. 1950. Wildfire disease of tobacco and soybeans. Plant Dis. Reptr. 24:141–142.

Cross inoculations with the wildfire organisms from tobacco and soybean gave negative results. The soybean isolate caused only slight infection on soybean in 2 out of 22 separate tests.

390. CLINTON, G. P. 1916. Notes on plant diseases of Connecticut. Connecticut Agr. Expt. Sta. Ann. Rpt. 1915, pp. 421–451.

Records on soybeans a bacterial leaf spot caused by *Bacillus* sp., a chlorosis, and a crinkling disease.

391. CLINTON, G. P. 1934. Plant pest handbook for Connecticut. II. Diseases and injuries. Connecticut Agr. Expt. Sta. Bull. 358, pp. 153–329.

Bacterium glycineum (= *Pseudomonas glycinea*), and *B.* (= *Xanthomonas*) *phaseoli* var. *sojense* both were isolated from bacterial spot disease. *Botrytis cinerea* killed the leaves. Crinkling chlorosis, probably of virus origin, was also noted.

392. CLOSE, D. C., D. R. WATSON, and J. M. DINGLEY. 1970. Soybean diseases in New Zealand. New Zealand J. Agr. 120(2):79.

Describes the diseases caused by *Pseudomonas glycinea, Peronospora manshurica,* stem rot, soybean mosaic virus, and pea leaf roll virus. *P. manshurica* causing severe damage in some crops was reported for the first time in New Zealand in 1968.

393. COBB, G. S., G. STEINER, and F. S. BLANTON. 1934. Observations on the significance of weeds as carriers of the bulb or stem nematodes in narcissus plantings. Plant Dis. Reptr. 18:127–128.

Soybean is listed as one of the plants infected by *Anguillulina dipsaci* (= *Ditylenchus dipsaci*).

394. COERPER, F. M. 1919. Bacterial blight of soybean. J. Agr. Res. 18:179–193.

Symptoms on leaves are most conspicuous. Characterized by small angular spots, light-colored and translucent in early stage and very dark-colored in late stage, which become dry and drop out. Bacterial exudate occurs on leaf spots. Infection also occurs on petiole, stem, and pod. The causal organism is named *Bacterium glycineum* (= *Pseudomonas glycinea*). Spraying plants with a suspension of the organism causes symptom productions. Best growth of organism occurs between 24–26 C. Orga-

nism is sensitive to desiccation and gradually loses pathogenicity in cultures. Certain variation occurs between strains. Invasion occurs in the parenchyma.

395. COLBRAN, R. E. 1958. Studies of plant and soil nematodes. II. Queensland host records on root-knot nematodes (*Meloidogyne* species). Queensland J. Agr. Sci. 15:101–136.

Meloidogyne species found in Queensland are *M. javanica, M. hapla,* and *M. incognita.* Within these species there are distinct physiological races. The records are presented in two sections. In the first, the hosts are alphabetically arranged with data on nematode parasites, maximum severity of infestation observed, locality, and susceptibility of test plants; in the second, the relevant hosts are listed under each of the *Meloidogyne* species. The host list includes 269 species in 62 botanical families. Many of these are new records.

396. COLLINS, R. J., and R. RODRIGUEZ-KABANA. 1971. Relationship of fertilizer treatments and crop sequence to populations of lesion nematodes. J. Nematol. 3:306–307. (Abstr.)

The effect of fertilizer treatments on populations of lesion nematodes in field plots was studied for 2 years in an established long-term fertilizer experiment with the following rotation sequence: corn, winter wheat, soybeans, fallow, cotton, and in some plots winter legume (crimson clover + vetch) as green manure. The experiment consisted of three tiers rotating every year to the three major crops: corn (Fla-200A), soybeans (Bragg), and cotton (Auburn 56). Each tier of ten 30 × 5.5 m plots received the same treatment and rotation sequence continuously for at least 10 years. Fertilizer treatments varied from a complete formulation (N, P, K, lime, minor elements) to treatments deficient in one or more components. Soil and root populations of a lesion nematode species (closely resembling *Pratylenchus scribneri* Steiner) were higher in soybean and cotton plots receiving no fertilization and no winter legume than in plots receiving all major elements, lime and a winter legume. The reverse was true in corn plots. The number of lesion nematodes in soil and root samples from soybean plots receiving no N was higher than in plots with N supplied via a winter legume. Soybeans and corn in plots receiving N through the activity of a winter legume supported significantly lower numbers of lesion nematodes than when inorganic N was used.

Yields of all crops were depressed and higher numbers of lesion nematodes developed in the P-deficient plots than in those receiving complete fertilization. In P-deficient plots, the number of lesion nematodes were in the order: corn > soybeans > cotton. Omission of K fertilization depressed yields of all crops but the numbers of lesion nematodes present were generally equivalent to those found in plots with complete fertilization. Unlimed plots had lower pH values (5.4) than limed plots (6.2–6.5) and generally showed greatest seasonal fluctuations in numbers of lesion nematodes. Highest populations of lesion nematodes were found in unlimed plots planted to cotton and soybean. Well-fertilized plots receiving P in the form of triple superphosphate had lower numbers of lesion nematodes and slightly higher yields than those that received superphosphate. Addition of minor elements to limed plots receiving all three major elements increased yields of all crops but did not significantly affect lesion nematode populations in soybeans or cotton.

397. COLWELL, W. E. 1945. Fertilizing soys in North Carolina. Soybean Dig. 5(3):11–12.

Soybeans grown on the dark, highly organic, poorly drained soils of the North Carolina Lower Coastal Plain suffered from potash deficiency. The application of muriate of potash as top dressing is recommended.

398. CONNERS, I. L. 1936. Fifteenth annual report of the Canadian plant disease survey, 1935. 76 pp.

Records the occurrence of *Bacterium glycineum* (= *Pseudomonas glycinea*), curly top, and *Peronospora manshurica.*

399. CONNERS, I. L., and D. B. O. SAVILE. 1943. Twenty-second annual report of the Canadian plant disease survey, 1942. 110 pp.

New records of the occurrence of pod and stem blight (*Diaporthe phaseolorum* var. *sojae*), and anthracnose (*Colletotrichum dematium* f. *truncata*) in Canada.

400. CONNERS, I. L., and D. B. O. SAVILE. 1944. Twenty-third annual report of the Canadian plant disease survey, 1943. 122 pp.

Records occurrence and prevalence of the following pathogens on soybean: *Fusarium oxysporum* f. *tracheiphilum, Diaporthe sojae* (= *D. phaseolorum* var. *sojae*), *Peronospora manshurica, Phyllosticta sojaecola, Cercospora sojina, Septoria glycines, Colletotrichum glycines* (= *C. dematium* f. *truncata*), *Pseudomonas glycinea, Ascochyta* sp., *Alternaria* sp., and mosaic virus.

401. CONNERS, I. L., and D. B. O. SAVILE. 1945. Twenty-fourth annual report of the Canadian plant disease survey, 1944. 122 pp.

Soybean diseases were of only slight importance in southwestern Ontario, but bud blight (tobacco ring spot virus) and charcoal rot (*Macrophomina phaseolina*) were recognized for the first time.

402. CONNERS, I. L., and D. B. O. SAVILE. 1949. Twenty-eighth annual report of the Canadian plant disease survey, 1948. 118 pp.

Cephalosporium gregatum attacked several cultivars.

403. CONNERS, I. L., and D. B. O. SAVILE. 1951. Thirtieth annual report of the Canadian plant disease survey, 1950. 135 pp.

Soybeans in western Ontario were attacked by *Diaporthe phaseolorum* var. *sojae* and *D. p.* var *batatatis* (= *D. p.* var. *caulivora*).

404. CONNERS, I. L. 1954. Thirty-third annual report of the Canadian plant disease survey, 1953. 124 pp.

Fungal diseases of soybean were of little importance during the period under review, but *Xanthomonas phaseoli* var. *sojense* was found on soybeans in Ottawa, a new record for Canada.

405. CONNERS, I. L., R. A. SHOEMAKER, and D. W. CREELMAN. 1957. Thirty-sixth annual report of the Canadian plant disease survey, 1956. 134 pp.

Severe damage was caused to soybean in southwestern Ontario by an undetermined species of *Phytophthora* causing root and stalk rot.

406. CONOVER, R. A. 1948. Studies of two viruses causing mosaic diseases in soybean. Phytopathology 38: 724–735.

The symptoms of soybean mosaic, caused by Soja virus 1 (mosaic), and of yellow mosaic, caused by a strain of *Phaseolus* virus 2, are described. Soybean mosaic was severe at 18.5 C and largely masked at 29.5 C. Soja virus 1 produced systemic infection only on soybeans, but was recovered from the symptomless inoculated leaves of certain varieties of garden beans. The virus was transmitted by pea aphid and peach aphid, and also through seeds. The thermal inactivation point was 64–66 C; longevity in vitro 4–5 days. Yellow mosaic was not markedly affected by air temperature. The virus induced mottling on several other legumes. The thermal inactivation point was 54–56 C; longevity in vitro 3–4 days. It was not seed-transmitted.

407. COOK, M. T. 1935. Host index of virus diseases of plants. Puerto Rico Univ. J. Agr. 20:315–406.

Soybean mosaic reported in 1929 from Japan.

408. COOPER, W. E. 1949. Top necrosis, a virus disease of guar. Phytopathology 39:347–358.

Soybeans (cultivar S-100) were infected by inoculation with this new virus, producing a systemic stipple necrosis of young leaves followed by death of the stem tip.

409. CORBETT, D. C. M. 1963. The report of the plant pathologist. Nyasaland Dept. Agr., Ann. Rpt. 1961/62 (Part II), pp. 157–159.

First report of *Xanthomonas phaseoli* var. *sojense* for Nyasaland.

410. CORBETT, D. C. M. 1964. A supplementary list of plant diseases in Nyasaland. Commonw. Mycol. Inst., Mycol. Papers 95. 16 pp.

The following collections were reported on soybean: From Zomba — a leafspot caused by *Cercospora canescens;* a leafspot caused by *Mycosphaerella phaseolorum* causing premature defoliation; and bacterial pustule caused by *Xanthomonas phaseoli* var. *sojense*. From Liongwe — false rust caused by *Synchytrium dolichi.*

411. COSTA, A. S., S. MIYASAKA, and A. J. D'ANDREA PINTO. 1955. Soja bud blight, a disease caused by the Brazilian tobacco streak virus [English summary]. Bragantia 14:7–11.

A virus disease of soybeans closely resembling bud blight has been recorded from several areas in the state of São Paulo. Studies on cause of bud blight in these areas revealed that the responsible virus is the one that causes "nicrose branca" or "couve" of tobacco in Brazil, a disease referred to as Brazilian tobacco streak. This virus also causes mosaic of cotton and infects many other cultivated plants and weeds. Previous studies have indicated that the virus responsible for bud blight in Brazil is closer to American tobacco streak virus than to tobacco ring spot virus, being considered a strain of the former complex. It is suggested that, besides tobacco ring spot virus, tobacco streak virus also might be responsible for cases of soja bud blight in the United States.

412. COSTA, A. S. 1955. Studies on Abutilon mosaic in Brazil. Phytopath. Z. 24:97–112.

Inoculation of 320 soybean plants by insect vectors gave 100% infection. Natural field infections have been recorded. Affected plants are slightly reduced in size and the leaf mottling is composed of yellowish, light-green, and normal-green areas, with some rugosity and blistering. Pods are formed on the diseased plants. Mechanical inoculation produced no infection.

413. COSTA, A. S., and A. M. B. CARVALHO. 1960. Mechanical transmission and properties of the Abutilon mosaic virus. Phytopath. Z. 37:259–272.

For transmission tests, inoculum obtained from soybeans was generally poor even when tested on susceptible host plants.

414. COSTA, A. S., and A. M. B. CARVALHO. 1961. Studies on Brazilian tobacco streak. Phytopath. Z. 42: 113–138.

Naturally infected soybean plants closely resemble plants infected with the American bud blight. Brazilian tobacco streak is widespread in the state of São Paulo, Brazil. The virus is readily inactivated in expressed plant juice. In the presence of reducing substances such as Na_2SO_3, the virus preparation remains active for at least 9 hr. Dilution end point 5^{-6}, thermal inactivation point between 60–65 C.

415. COURSEN, B. W., R. A. ROHDE, and W. R. JENKINS. 1958. Additions to the host lists of the nematodes *Paratylenchus projectus* and *Trichodorus christiei.* Plant Dis. Reptr. 42:456–460.

Soybean cultivars Dorman, John Kolk Clark, Lee, and Ogden, are listed as host of the pin nematode, *Paratylenchus projectus.* The same cultivars, with the exception of Ogden, are listed as host of root nematode, *Trichodorus christiei.*

416. COX, C. E., and W. F. JEFFERS. 1946. Root-knot. Univ. Maryland Ext. Serv. Bull. 113.

Soybean is listed as susceptible to *Heterodera marioni.*

417. CRALL, J. M. 1947. Brown stem rot of soybean in Missouri. Plant Dis. Reptr. 31:14.

Records occurrence and symptoms of the disease. Causal organism is unidentified.

418. CRALL, J. M. 1948. Defoliation of soybean in Southeast Missouri caused by *Phyllosticta glycineum.* Plant Dis. Reptr. 32:184–186.

The fungus caused leaf spots and, in severe cases, commonly in association with bacterial blight, killed most leaves. Leaf spots were round to oval when small and occurred both at the margin and irregularly throughout the lamina of leaflet. The color varies from light to dark brown with a darker margin. At advanced stage, necrotic tissue may drop out. Finally, entire leaf is killed, petiole becomes light brown, and leaf either drops off or remains attached in dry conditions. Where leaf remains attached, the fungus enters stipules and stem tissues at leaf scar. The causal fungus is identified as *Phyllosticta glycineum* (= *P. sojaecola*). Pycnidia are globose to slightly applanate, membranous, with carbonous ostiole, 65–150 μ in diameter. Conidia are oblong to narrowly ellipsoid with rounded ends, hyaline to smoky, guttaelate, 2–3 $\times$ 5–7 μ.

419. CRALL, J. M., J. C. GILMAN, and G. L. MCNEW. 1949. A study of soybean diseases and their control. Iowa Agr. Expt. Sta. Rpt. on Agr. Res. for the year ending 30 June 1949, pp. 175–176.

Seed treatment with arasan, phygon, and spergon increased the emergence of Earlyana soybeans in 1948. *Phyllosticta glycineum* caused premature defoliation and may have reduced yields in some fields. Survey of the soybean-growing areas showed that brown stem rot (*Cephalosporium gregatum*) was most prevalent throughout the states; stem canker caused by *Diaporthe phaseolorum batatatis* (= *D. ph.* var. *caulivora*) occurred in some spots.

420. CRALL, J. M. 1950. Soybean diseases in Iowa in 1949. Plant Dis. Reptr. 34:96–97.

Records the distribution, seasonal occurrence, and prevalence of *Xanthomonas phaseoli* var. *sojense, Peronospora manshurica, Septoria glycines, Rhizoctonia solani, Macrophomina phaseoli* (= *M. phaseolina*), *Cephalosporium gregatum* (= *Philophora gregata*), *Diaporthe phaseolorum* var. *batatatis* (= *D.p.* var. *caulivora*), *Pseudomonas tabaci,* and bud blight (tobacco ring spot virus).

421. CRALL, J. M. 1951. Soybean diseases in Iowa in 1950. Plant Dis. Reptr. 35:320–321.

Reports the prevalence of *Diaporthe phaseolorum* var. *batatatis* (= *D. ph.* var. *caulivora*), *D. phaseolorum* var. *sojae, Cephalosporium gregatum, Rhizoctonia solani, Septoria glycines, Peronospora manshurica, Colletotrichum truncatum* (= *C. dematium* f. *truncata*), *Macrophomina phaseoli* (= *M. phaseolina*), *Cercosporina* (= *Cercospora*) *kikuchii, Pseudomonas glycinea, P. tabaci, Xanthomonas phaseoli* var. *sojense,* bud blight virus, mosaic virus, and yellow mosaic virus.

422. CRALL, J. M. 1952. Soybean diseases in Iowa in 1951. Plant Dis. Reptr. 36:302.

Report on the occurrence of *Diaporthe phaseolorum* var. *batatatis* (= *D.p.* var. *caulivora*), *Rhizoctonia solani, Pseudomonas glycinea, Xanthomonas phaseoli* var. *sojense, P. tabaci, Septoria glycines, Peronospora manshurica, Cercospora daizu* (= *C. sojina*), *Phyllosticta glycineum* (= *P. sojaecola*), *Cercosporina kikuchii* (= *Cercospora kikuchii*), *D. phaseolorum* var. *sojae, Cephalosporium gregatum* (= *Philophora gregata*), mosaic virus, and potassium deficiency.

423. CRALL, J. M. 1956. Observations on the occurrence of soybean stem canker. Phytopathology 46:10. (Abstr.)

Studies on Diaporthe stem canker of soybean were made in Iowa during 1948–1952. Infections occurred on both blade and petiolar portions of leaves and usual means of entry of the stem canker fungus was at base of petioles, not through leaf scars or stem wounds as reported by other workers. Perithecia and mature ascospores were found infrequently on infected plants, providing possible means of secondary spread of the disease. Average daily mean temperatures below 70 F favored development of stem canker in the field, whereas 60 F was optimum in greenhouse tests. A highly significant regression coefficient (− 0.268 bu./acre per unit percentage infection) was determined for the effect of stem canker on soybean yields. Regression of stem canker infection on plant maturity was positive and highly significant. Regression of infection on lodging was negative and highly significant. The latter probably accounts for extreme susceptibility of the lodging-resistant cultivars Hawkesbury and Blackhawk reported by some workers.

424. CRALLEY, E. M., and R. L. BEECHER. 1951. The control of soybean chlorosis in rice-growing areas of Arkansas by potassium applications. Phytopathology 41: 7–8. (Abstr.)

Soybean chlorosis resembling K deficiency in symptoms, has been observed for several years in some rice-growing areas of Arkansas. The disease was first observed in fields where soybeans followed rice in the rotation system and was most conspicuous in narrow bands in the fields, which coincided with location of the leveled rice leaves.

The disease has gradually increased in importance to the point where large acreages are involved, and 75% of plants in certain fields show deficiency symptoms. Soil analysis showed that soils in the areas involved were alkaline (pH 7.0 to 8.2) and low in replaceable K, and also showed exceptionally high concentrations of Ca and Mg (replaceable Ca to K ratios greater than 60:1). Fertilizer tests were conducted using K alone and in combination with N, P, and minor elements. Results showed that K, alone (30–80 lb./acre of available K_2O) or in combination with N and P, prevented chlorosis when applied at the planting time and resulted in marked recovery of the plants when applied as a side-dressing after plants were showing deficiency symptoms.

425. CRANDALL, B. S., and J. DIEGUEZ. 1948. A check list of diseases of economic plants in the Tingo Maria zone of the Peruvian Montana. Plant Dis. Reptr. 32:20–27.

Includes *Sclerotium rolfsii* on soybeans.

426. CRANE, J. L., and H. W. CRITTENDEN. 1962. Effect of deflowering and tobacco ring spot virus on the occurrence of *Cercospora kikuchii* on soybean. Phytopathology 62:1217. (Abstr.)

Studies of *Cercospora kikuchii* on soybean seed were initiated to determine why a pure soybean line has varying amounts of purple-stained seed when grown in contiguous fields on the same farm. Soybean plants (line UD 288) were deflowered manually in a field test, 0, 1, 2, 3, and 4 weeks after onset of flowering. Every additional week of deflowering delayed plant maturity. All treatments were harvested the same day and threshed in a single-plant thresher. Percentage of purple-stained soybean seed by treatments was: 12%, 13%, 29%, 37%, and 41%, respectively. These figures were highly significant upon analysis. In another field test, certain plants of soybean cultivar Bethel, 6 weeks old, were inoculated with tobacco ring spot virus. Virus delayed plant maturity, but plants with and without the virus were harvested the same day. Purple-stained seed was 26% and 6%, respectively. Thus two separate tests showed that a delay in normal maturity of plant caused a marked increase of purple-stained soybean seeds.

427. CRANE, J. L., and H. W. CRITTENDEN. 1966. The relation of soybean seed infected by *Cercospora kikuchii* to the duration of certain plant developmental stages. Plant Dis. Reptr. 50:464–468.

Data on the relationship of length of certain soybean developmental stages to purple stain incidence in seed coats were collected on selected plant introductions and cultivars subjected to natural infection by the fungus *Cercospora kikuchii*. Results indicate that length of flowering period appears to be a critical factor in determining the reaction of certain soybeans to *C. kikuchii*. No relationship could be established between amount of purple stain and duration of the preflowering, postflowering, and pod-maturity periods in the soybeans studied. Soybean maturity was delayed by deflowering in certain plant introductions and cultivars. Results indicate that delayed maturity caused a significant increase in amount of purple-stained seed in some but not all of the soybeans tested.

428. CRANE, J. L., and H. W. CRITTENDEN. 1967. Growth of *Cercospora kikuchii* on various media. Plant Dis. Reptr. 51:112–114.

Laboratory experiments were conducted with *Cercospora kikuchii* on media of varying composition. The three standard agar media used were: Bacto, Czapek, and potato-dextrose. Other media were prepared from various parts of seeds of Kent and Hill soybean cultivars. Field data indicated that Kent may have a rather high amount of *C. kikuchii* in the seed coats whereas Hill may have a low amount. In the laboratory, growth of *C. kikuchii* was excellent on a seed coat medium of both Kent and Hill. Growth of the fungus was restricted on media prepared with cotyledons of each variety. Use of Kent or Hill tissues containing chlorophyll, for laboratory media, restricted growth of *C. kikuchii* very severely compared with a seed coat medium or standard potato-dextrose agar.

429. CREELMAN, D. W. 1965. Summary of the prevalence of plant diseases in Canada 1964. Canad. Plant Dis. Survey. 45:37–83.

Colletotrichum truncatum (= *C. dematium* f. *truncata*) on soybean is prevalent in Canada.

430. CRISPIN, A., and C. C. GALLEGOS. 1963. Web blight: a severe disease of beans and soybeans in Mexico. Plant Dis. Reptr. 47:1010–1011.

Web blight (*Rhizoctonia microsclerotia* = *R. solani*) caused a severe leaf spot of beans and soybean for the first time in Mexico. Symptoms resemble common bacterial blight, but quick decline of plants and presence of small sclerotia on diseased areas make this disease different from bacterial blight.

431. CRITOPOULOS, P. D. 1953. A contribution on the fungus flora of Greece. Torrey Bot. Club Bull. 80, pp. 325–341.

Two specimens of *Macrophomina phaseoli* (= *M. phaseolina*) were collected 10 August 1940 at Botaniko, Athens. The sclerotia occur in vessels and pith of the lower part of the stem. In one specimen sclerotia taken from the pith were spherical to ellipsoid 60–165 × 57–114 μ, and in the other, 36–99 × 36–81 μ.

432. CRITTENDEN, H. W. 1952. Progress in the search for a root-knot nematode resistant crop. Trans. Peninsula Hort. Soc., Delaware State Bd. Agr., Bull. 42, pp. 28–31.

In a root-knot control program there is a need for a resistant crop that can be rotated with vegetables and is profitable to grow. Three commercial cultivars of soybean (Anderson, Monroe, and Blackhawk), acceptable for seed production in Delaware, appear to have a high degree of resistance to the root-knot nematode, *Meloidogyne incognita acrita.* Laredo was the most resistant cultivar tested but it is suitable only for hay or a green manure crop in Delaware.

433. CRITTENDEN, H. W. 1953. Progress in control of the root-knot nematodes by the use of clean fallow. Trans. Peninsula Hort. Soc., Delaware State Bd. Agr., Bull. 43, pp. 15–18.

In two experiments, root-knot infection of soybean caused by *Meloidogyne incognita* var. *acrita* became progressively lower as the period of clean fallow increased. Soybeans were planted at intervals, beginning May 15 and ending August 15; fallowed soil was maintained free of vegetation by tilling once every 2 weeks. Clean fallow in May and June followed by a cash crop in the same growing season is economical control. The primary environmental factor responsible for inoculum reduction appears to be elimination of susceptible hosts.

434. CRITTENDEN, H. W. 1953. Effect of clean fallow in root-knot development on soybeans. Phytopathology 43:405. (Abstr.)

Field experiments in Delaware in 1951 indicated that root-knot nematodes were reduced as a result of clean fallow of the soil during June. Field experiments in 1952 were designed to check these results. All ground was prepared on May 1 and certain plots were kept in clean fallow by cultivation once every 2 weeks from May 1 to time of planting. Dates of planting soybeans were May 15, June 1, June 15, and July 1. Seed was sown in rows 6 in. apart; no cultivation occurred following planting date. The root-knot indices (100 = maximum infection) obtained from examination of roots of 90-day-old plants from plots planted at different dates were: 50, May 15; 56, June 1; 17, June 15; and 4, July 1. Plots not in clean fallow in May and June were planted to soybean on July 1 and the root-knot index of these plants after 90 days was 40. These experiments, using soybeans, indicate that root-knot nematodes in the top 6 in. of soil were greatly reduced as a result of clean fallow and cultivation of a loamy sand during June.

435. CRITTENDEN, H. W. 1954. Factors associated with root-knot nematode resistance in soybeans. Phytopathology 44:388. (Abstr.)

In the search for soybean cultivars having resistance to one of the root-knot nematode species, namely, *Meloidogyne incognita* var. *acrita,* it has been found that certain morphological and physiological features appear to be associated with resistance. In the search for resistant cultivars, they should have some or all of these features: 1) long, tapering roots that penetrate deep into the soil and possess a minimum of lateral roots; 2) roots with a tendency to become more woody than fleshy early in development of the plant; 3) acceptable growth and yield in soils containing low amounts of K; 4) lowest percentage of oil in the seeds that is commercially acceptable. The cultivar Laredo has the greatest resistance of any tested to date, but is suitable only for hay or a green manure crop in Delaware. Three commercial cultivars (Blackhawk, Monroe, and Anderson), acceptable for seed production in Delaware, appear to have a high degree of resistance to *M. incognita* var. *acrita.*

436. CRITTENDEN, H. W. 1955. Root-knot nematode resistance of soybeans. Phytopathology 45:347. (Abstr.)

Fifty cultivars of soybeans have been tested in Delaware for resistance to *Meloidogyne incognita* var. *acrita.* These include representatives from all maturity groups from 0 to VIII. Cultivars in group 0 are suitable for the northern United States and those in group VIII are grown in the Gulf Coast region. The following 10 cultivars have shown high resistance: Laredo (Group VI), Mukden (II), Anderson (IV), Monroe (I), Blackhawk (I), Peking (IV), Mendota (II), Haberlandt (V), Habaro (I), and Mandarin 507 (I). The five cultivars having the highest resistance to *M. incognita* var. *acrita* have been tested also against *M. hapla.* All five (Laredo, Mukden, Anderson, Monroe, and Blackhawk) were susceptible. These findings emphasize that: (1) the growing of a crop resistant to *M. incognita* var. *acrita* may selectively increase populations of *M. hapla;* and (2) until combined resistance is obtained, it appears essential to know the identity of the root-knot nematode species in any area where rotations are used for control.

437. CRITTENDEN, H. W. 1956. Control of *Meloidogyne incognita acrita* by crop rotation. Plant Dis. Reptr. 40:977–980.

It is shown that the best rotations for control of *Meloidogyne incognita acrita* based upon amount of root-knot on cantaloupe in 1955, are: (1) *Crotalaria spectabilis,* Blackhawk soybean, and clean fallow in May and June followed by Monroe soybean. This represents three consecutive years of resistant crops. (2) Two years of Blackhawk soybean equalled the control given by the three years of resistant crops. (3) *Crotalaria spectabilis* and Monroe soybean gave essentially the same control as the two preceding rotations. One year of a resistant crop results in some control on a susceptible crop the next year. This degree of control may be satisfactory under some conditions. Thus, it is concluded that best control results from use of resistant crops for two consecutive years. Furthermore, use of a cash crop such as resistant soybeans appears to be a very economical method of control.

438. CRITTENDEN, H. W. 1958. Histology and cytology of susceptible and resistant soybeans infected with *Meloidogyne incognita acrita.* Phytopathology 48:461. (Abstr.)

Three cultivars of root-knot nematode susceptible soybeans (Virginia, Adams, and Hakote) and 5 resistant varieties (Blackhawk, Mukden, Anderson, Laredo, and Jackson) were exposed to *Meloidogyne incognita acrita.* Collections were made of roots at 4, 8, 16, and 32 days of age. Each of the 3 susceptible varieties exhibited the following characteristics: (1) giant cells surrounding head of the nematode; (2) large number of giant cells; (3) large size of giant-cell area; (4) very dense cytoplasm within giant cells; (5) great number of enlarged nuclei in each giant cell; and (6) great enlargement of pericycle, with giant cells occurring frequently in this region. The 5 resistant cultivars exhibited a gradation of abnormal tissues and cells that corresponded to the degree of resistance based on field and greenhouse tests. Very resistant cultivars (Laredo, Anderson) showed: (1) head of nematode not surrounded by giant cells; (2) small number of giant cells; (3) small size of giant-cell area; (4) cytoplasm of giant cells sparse and not dense; (5) small number of enlarged nuclei in each giant cell; and (6) enlargement of pericycle small or none, with no giant cells in this region.

439. CRITTENDEN, H. W. 1959. Pathogen-suspect relationship of *Meloidogyne incognita acrita* and *Glycine max.* Diss. Abstr. 19:2219.

The roots of susceptible and resistant cultivars of soybean were examined after inoculating them with *Meloidogyne incognita* var. *acrita* larvae. Healthy plants were also examined. No cytological or histological differences were observed between the roots of uninfected healthy susceptible and resistant cultivars of soybeans. These differences were evident in the case of infected plants. The giant cells occupied much smaller spaces in the roots of resistant cultivars and the nematode's head was at the side of these cells. In the susceptible varieties the head was surrounded by the giant cells, which had dense cytoplasm and irregularly thickened walls. The areas of larval invasion of the susceptible plants showed an increased number and size of pericycle cells, whereas this phenomenon was, if at all, manifested to a much lesser degree in the resistant cultivars. In susceptible soybean plants there was likewise a reduction in the number of tertiary roots as a result of infection of the primary and the secondary ones. Soybeans were most susceptible to *M. incognita* var. *acrita* infection at sowing time, but they remained so to some degree for nine weeks after sowing.

440. CRITTENDEN, H. W. 1959. Production of lateral roots in soybean varieties resistant and susceptible to *Meloidogyne incognita acrita.* Phytopathology 49:523. (Abstr.)

Two soybean cultivars (Virginia and Adams) susceptible to root-knot nematode and two resistant cultivars (Laredo and Anderson) were exposed to *Meloidogyne incognita acrita* for 8, 16, and 32 days; these cultivars also were grown in uninfested soil for similar periods. When secondary roots were invaded by the nematode, each of the two susceptible cultivars, at 8 and 16 days of age, exhibited a reduction in number of tertiary roots produced (significant at 0.01 level) as compared to number of tertiary roots produced on the same cultivars in uninfested soil. Each of the resistant cultivars exhibited no change in tertiary roots produced on the same cultivars in uninfested soil, and no change in tertiary root production when grown in infested soil compared to roots produced in uninfested soil. Enlargement of the pericyclic region in numerous areas of secondary roots of susceptible soybean cultivars invaded by nematodes has a high positive correlation with inhibition of tertiary roots in these same cultivars. Size of gall caused by *M. incognita acrita* and number of lateral roots produced in soybean are affected by K.

441. CRITTENDEN, H. W., and H. W. BLOSS. 1960. Control of *Cercospora kikuchii* and *Diaporthe phaseolorum* var. *sojae* on soybean seed. Phytopathology 50:570. (Abstr.)

Six spray applications of zineb (1½ lb.), maneb (1½ lb.), and tribasic $CuSO_4$ (2 lb.) were made on Clark soybean at 10-day intervals from 5 August to 1 October 1958. Each fungicide gave excellent control of *Cercospora kikuchii* but no control of *Diaporthe phaseolorum* var. *sojae.* In 1959, sprays of zineb (2 lb.) and tribasic $CuSO_4$ (2 lb.) were applied at 7-day intervals on Clark soybean, the number of applications and their timing being varied from July 8 to September 3. Zineb and tribasic $CuSO_4$ applied four times from July 29 to August 19 gave almost complete control of *C. kikuchii;* one, two, and three applications of each of these fungicides gave some control of *C. kikuchii* when timed to occur July 29 to August 19. Zineb gave better control of *D. phaseolorum* var. *sojae* than did tribasic $CuSO_4$; six sprays of zineb from July 15 to August 19 were necessary for good control. Control of *C. kikuchii* and *D. phaseolorum* var. *sojae* was best when sprays were applied during flowering period of the soybean.

442. CRITTENDEN, H. W. 1961. Studies of the host range of *Meloidogyne incognita acrita.* Plant Dis. Reptr. 45:190–191.

This report covers field and greenhouse studies in Delaware of the host range of *Meloidogyne incognita* var. *acrita.* Resistance to *M. incognita* var. *acrita* exists in soybean. The use of resistant soybean cultivars in the summer and a resistant oat variety as a winter cover crop is suggested as a nematode control program. Soybean cultivars Blackhawk, F.C. 33242, Habaro, Haberlandt, Jackson, Laredo, Mandarin, Mendota, Monroe, Mukden, Peking, were found resistant to this nematode.

443. CRITTENDEN, H. W. 1962. Effect of *Meloidogyne incognita acrita* in nodulating and non-nodulating strains of soybean. Phytopathology 52:163. (Abstr.)

Tests were conducted with plants of two nearly isogenic lines of soybean essentially identical in genetic composition except for the single gene for nodulation and nonnodulation. Both lines trace back to the same BC_1S_2 plant from a Lincoln × (Lincoln × Richland) backcross made in 1943. Seed was planted in the greenhouse in steam-sterilized soil and in soil infested with both *Meloidogyne incognita* var. *acrita* and legume bacteria. The plants were grown 42 days in an environment conducive for deposition of nematode eggs in 32 days. Root systems had a small number of nodules on the nodulating strain. Microscopic examination of primary roots showed that *M. incognita* var. *acrita* caused excessive root enlargement of the nodulating strain but only slight root enlargement of the nonnodulating strain. (In the cytopathology of root-knot nematode-invaded roots, the term "lysigenoma," a morbid condition formed by the breaking down of adjoining cells, is proposed for the nematode feeding area formerly known as "giant cells.") The lysigenomata present in the roots were not significantly different in the nodulating and nonnodulating strains; however, maturation of females occurred more quickly in the nonnodulating strain.

444. CRITTENDEN, H. W., K. M. HASTINGS, and D. M. MOORE. 1966. Soybean losses caused by tobacco ring spot virus. Plant Dis. Reptr. 50:910–913.

A natural outbreak of tobacco ring spot virus occurred in 1964 in an area of soybeans planted in a crop rotation experiment at the Delaware Agricultural Experiment Station at Georgetown. Where the virus was present, reduction of seed yield was greater than 50%. The seed crop from plants infected with this virus showed a low germination in Terralite or in sand in greenhouse tests. Presence of the virus was associated with reduction in height of young seedlings grown in the greenhouse and an increase in number of purple-stained seed coats caused by *Cercospora kikuchii*. Soybean losses due to this virus include more than the immediate loss of seed yield.

445. CROMWELL, R. O. 1917. Fusarium-blight, or wilt disease of soybean. Agr. Res. 8:421–440.

First detailed account is given of Fusarium blight or wilt caused by *Fusarium tracheiphilum* (= *F. oxysporum* f. *tracheiphilum*) found in North Carolina. By cultural and morphological studies as well as inoculation experiments, the disease was proved to be identical with cowpea wilt. Largest portion of diseased plants occurred on coarse sandy soil. Infected plants are stunted with considerable defoliation. Leaves that persist on plant are chlorotic. Wilting is not a prominent symptom but is present in some young plants. Therefore the name "blight" or "wilt" is applied. In early stage only the xylem near the pith is found to have fungal filaments but later, other xylems are also invaded and filled with network of the hyphae. Morphological characters of the fungus are described.

446. CROMWELL, R. O. 1919. Fusarium blight of the soybean and the relation of various factors to infection. Nebraska Agr. Expt. Sta. Res. Bull. 14, pp. 1–43.

The physical structure of soils under natural conditions is not the limiting factor in the infection, but acidity under certain conditions has some influence. Infection occurs through roots. Nematodes do not increase percentage of blight, but *Rhizoctonia* sp. and *Sclerotium rolfsii* increase the percentage of *Fusarium*-infected plants. Cultivar Black Eyebrow is resistant, and Brown is tolerant.

447. CROSS, J. E., and B. W. KENNEDY. 1964. Variability in pathogenicity in *Pseudomonas glycinea*. Phytopathology 54:890–891. (Abstr.)

Pathogenicity of 10 single-colony isolates of *Pseudomonas glycinea* was compared by inoculation of 10 cultivars of soybeans in the greenhouse. Isolates originated in Illinois, Iowa, Mississippi, Missouri, North Carolina, and Minnesota. Host cultivars consisted of 9 commercially grown in Minnesota plus a resistant selection from Illinois. Two-week-old seedlings were inoculated in the following manner: one cotyledon was clipped off with scissors dipped in standardized bacterial suspensions. After 2–3 weeks lesions formed and were graded according to color, length, and degree of splitting of the hypocotyl. There were statistically significant differences in pathogenicity between the various isolates; two Minnesota isolates were most virulent on a greater number of cultivars. Norchief was moderately resistant to the most virulent isolate, while Chippewa, a field-tolerant cultivar in Minnesota, was susceptible. Isolates from Missouri and North Carolina produced lesions of similar size on all 10 differentials, whereas the other 8 were pathogenically distinct from one another. A distinct reddening of the hypocotyls was produced by 4 isolates, and this symptom was correlated with pathogenicity. These investigations indicate wide pathogenic diversity in *P. glycinea.*

448. CROSS, J. E., B. W. KENNEDY, J. W. LAMBERT, and R. L. COOPER. 1966. Pathogenic races of bacterial blight pathogen of soybeans, *Pseudomonas glycinea*. Plant Dis. Reptr. 50:557–560.

Seven pathogenic races of *Pseudomonas glycinea* were distinguished by inoculating unifoliolate leaves of soybean cultivars Acme, Chippewa, Flambeau, Harosoy, Lindarin, Merit, and Norchief with an airbrush sprayer using inoculum containing 10–20 × 10^6 cells/ml. There was apparently no relationship between pathogenicity and cultural or serological characters. Distribution of pathogenic races in Minnesota was dependent on host cultivar. One race predominated on cultivars regarded as resistant, whereas another race was found on those

classified as susceptible. It was unusual to find more than one pathogenic race in a single field.

448a. CROSSAN, D. O. F. 1953. Comparative studies on species of *Ascochyta* from okra, bean, and cotton in North Carolina. Phytopathology 43:469. (Abstr.)

Isolates from okra, bean, and cotton were pathogenic to soybeans.

449. CROWLEY, N. C. 1959. Studies on the time of embryo infection by seed-transmitted viruses. Virology 8:116–123.

When cultivars Lincoln and Virginia were inoculated prior to flowering with bean southern mosaic virus, the virus was detected in almost 100% of the testa and perisperm tissues but could not be detected in the embryos when more than 100 seeds were dissected. In temperature studies, 95% embryo infection occurred in plants grown at 16–20 C, but only 55% occurred at 28–30 C. When cultivars Lincoln, Chippewa, and Blackhawk were inoculated with tobacco ring spot virus, it is shown that a small proportion of embryo infection can take place in the early stages of embryo development.

450. CUMMINS, G. B. 1950. Uredinales of continental China collected by S. Y. Cheo. I. Mycologia 42:779–797.

Phakopsora pachyrhizi were collected at Anhwei in 1932, in Kiangsi in 1932, and at Kweichow in 1931.

451. CURTIS, C. R., and N. M. BARNETT. 1972. Polyacrylamide disc-gel electrophoresis and isoelectric focusing of proteins released from soybean hypocotyl cell walls by culture filtrate of *Sclerotium rolfsii*. Phytopathology 62:688. (Abstr.)

Many proteins were released from cell walls of soybean (Hawkeye 63) hypocotyls incubated with culture filtrate from *Sclerotium rolfsii*. Fungal culture filtrate was obtained from 4-week-old cultures growing on an autoclaved mixture 1:1 (w/v) of fresh soybean hypocotyls and H_2O. Incubation of 10 ml of culture filtrate in pH 4 acetate buffer 0.1 M for 30 min. at 30 C released many bound cell-wall proteins. The mixture of cell-wall proteins and filtrate was dialyzed and the proteins were then subjected to either disc electrophoresis or isoelectric focusing in polyacrylamide gels in a pH 3–10 gradient. The gels were photopolymerized with riboflavin rather than persulfate-polymerized. Tests for peroxidase and esterase activity were made. Best separation into discrete bands of peroxidase or esterase activity occurred using isoelectric focusing techniques. Fungal culture filtrate contained no detectable peroxidase activity before or after disc electrophoresis, but the filtrate did have esterase activity.

452. CURTIS, C. R., and R. K. HOWELL. 1973. Peroxidase response of Wayne and York soybeans to ozone. 2nd Internatl. Cong. Plant Path. 0577. (Abstr.)

Soybeans were grown in filtered air 14 days and then exposed 2 hr. to 35 ppm ozone. Control plants were not exposed to ozone. Leaves were harvested from all plants 24 hr. after exposure to ozone and homogenized in 0.1 M Tris buffer containing cysteine and ascorbic acid added at 100 mg/100 ml buffer, pH 8. The homogenate was centrifuged at 30,000 g for 30 min. at 2 to 4 C. The supernatant (100 μl) was layered on 5% photopolymerized polyacrylamide gels for isoelectric focusing in a pH 3 to 10 gradient for 4 to 5 hr. at 2 ma/gel, but not exceeding 400 v. The gels were tested for peroxidase activity using benzidine-HCl. Ozone-treated plants contained more peroxidase isoenzymes than did controls in both Wayne and York soybeans. Several other peroxidase isoenzymes were intensified by ozone treatment. Wayne soybeans were considered to be more sensitive to ozone than York. Although York rates as one of the more ozone-tolerant cultivars, both cultivars exhibited the peroxidase response induced by ozone. For a similar comparison, previously determined response in ozone-induced peroxidase isoenzymes was found in leaves of *Phaseolus vulgaris* Pinto III.

453. CUTURILO, S. 1952. Insects pests and plant diseases in the territory of the People's Republic of Serbia in 1951 [in Croatian, English summary]. Zashtita Bilja 11:21–42.

Occurrence of *Peronospora manshurica* is reported in Yugoslavia.

454. DA COSTA, G. C., and B. B. MUNDKUR. 1948. A revision of the genus *Phyllosticta* in India. Proc. Natl. Inst. Sci. India 14:55–63.

Phyllosticta glycines was collected on leaves in Kashmir in 1908.

455. DA COSTA NETO, J. P. 1943. Fungi of the Rio Grande do Sul observed during the years 1940–41 [in Portuguese]. Rio Grande do Sul Sec. de Estados dos Negoc. da Agr., Indus. e Com. Bol. 99.

States that a specimen of *Sclerotium bataticola* (= *Macrophomina phaseolina*) was collected near the city of Bage in 1941.

456. DADE, H. A. 1940. A revised list of Gold Coast fungi and plant diseases. Kew Roy. Gard. Bull. Misc. Inform. 1940, pp. 205–247.

Unidentified nematodes, found at Abusi and Kiki, were causing root-knot and stunting on soybeans.

457. DAFT, G. C., and C. LEBEN. 1971. Mechanics of infection of soybean seedlings by overwintered and secondary *Pseudomonas glycinea*. Phytopathology 61:889. (Abstr.)

An abstract of entry 459.

458. DAFT, G. C., and C. LEBEN. 1972. Bacterial

blight of soybeans: epidemiology of blight outbreaks. Phytopathology 62:57–62.

The relationship of wind-rain storms to the initiation of bacterial blight outbreaks incited by *Pseudomonas glycinea* on leaves of soybean was investigated. Initiation of outbreaks on young leaves occurred during three wind-rain storms. Lesions were often associated with obviously injured areas. Even though inoculum was present, little disease was initiated in the absence of storms or during rain without wind. Inoculum was transferred from plants with leaves showing lesions to healthy leaves of the same adjacent plants during simulated and natural storms. This was shown by development of new lesions and presence of pathogen in leaf surface water. The wind component of storms was an essential factor in disease initiation. When closely grouped greenhouse and field plants were agitated by wind and immediately subjected to inoculum in the form of gently falling mist, abundant blight developed on leaves. During natural or simulated wind-rain storms, lesions were not initiated on all leaves; only one to two of the youngest open leaves of a plant were infected.

459. DAFT, G. C., and C. LEBEN. 1972. Bacterial blight of soybeans: seedling infection during and after emergence. Phytopathology 62:1167–1170.

When soybean seeds were planted in soil containing abrasive particles and dried leaves infected with *Pseudomonas glycinea,* the number and size of lesions on cotyledons of emerged seedlings were increased. Most disease was on the proximal end of the cotyledon, which is advanced through the soil as the hypocotyl elongates. Disease was most severe in those areas where the growing hypocotyl usually contacted the cotyledon. Unifoliolate leaves were rarely diseased. No disease occurred on trifoliolate leaves. Upward transfer of inoculum on emerged seedlings was indicated when seedlings that had diseased cotyledons, unifoliolate, or first trifoliolate leaves were subjected to simulated wind-rain storms and new lesions developed on leaves above the organ that was diseased prior to application of the "storm" treatment.

460. DAFT, G. C., and C. LEBEN. 1973. Bacterial blight of soybeans: field-overwintered *Pseudomonas glycinea* as possible primary inoculum. Plant Dis. Reptr. 57:156–157.

Pseudomonas glycinea associated with diseased plant parts overwintered in and on pods in Ohio. Numbers of viable pathogen decreased during spring months. Seedlings from seeds planted near buried, overwintered, diseased leaves became diseased.

461. DALE, W. T. 1943. Preliminary studies of the plant viruses of Trinidad. Trop. Agr. (Trinidad) 20: 228–235.

Soybean appeared to be attacked by common cowpea mosaic in field and, when experimentally inoculated with the virus, very young soybean seedlings were very seriously affected.

462. DALE, W. T. 1949. Observations on a virus disease of cowpea in Trinidad. Ann. Appl. Biol. 36:327–333.

A virus causing mosaic of cowpea occasionally infects soybeans, producing mosaic symptoms. The infection occurs only when soybeans are growing near the infected cowpea fields. Physical properties, host range, and transmission of virus are described.

462a. DAMSTEEGT, V. D. 1974. Comparative study on the effects of virus infection on seed yield of field and greenhouse grown soybeans. Proc. Amer. Phytopath. Soc. 1:149 (Abstr.)

Soybean yield reductions caused by soybean mosaic virus (SMV), bean pod mottle virus (BPMV), and tobacco ring spot virus (TRSV) inoculated singly and in all combinations, were determined from plants grown in replicated field plots, greenhouse soil beds, and 4-in. clay pots. Plants of Cutler, Amsoy, Clark 63, and Kent were inoculated at the unifoliolate stage, and an additional set at floral initiation. Percent infection, symptom development, and seed yield were recorded. Combinations of two or more viruses resulted in greater yield loss (synergism) than did the single viruses of the respective combinations for plants grown in pots. Maximum yield loss resulted by the combination of the three viruses. The magnitude of additive effects varied more with host cultivar and culture method than with stage of development at inoculation. Greenhouse soil bed studies may be satisfactory to estimate field losses although cultivar confounding is indicated. Variations in host reactions in 4-in. clay pots preclude their use.

463. DANA, B. F. 1940. Occurrence of big bud of tomato in the Pacific Northwest. Phytopathology 30:866–869.

Occurrence of big bud disease of soybean in the United States.

464. DANA, B. F. 1941. Morphological and anatomical features of phyllody in varieties of tomatoes and beans. Phytopathology 31:168–175.

In soybean plants showing phyllody, the ovary varied from an inflated, sac-like structure, through a marginal-veined leaf with marginal leaflets replacing the ovules, to leaves of normal aspect. An extention of the axis between adjacent whorls of phylloid flower developed in the absence of adhesion or union between the vascular traces supplying these organs.

465. DANA, B. F. 1947. Phyllody of common beans, a graft-transmissible disease. Phytopathology 37:360–361.

Phyllody also occurs on soybean and other hosts, probably due to one or more strains of aster-yellows virus.

466. DANKO, J. 1962. The *Peronospora* of soybean — *Peronospora manshurica* (Naumoff) Syd. — in Slovakia [in Czech, German summary]. Ceska Mykol. 16: 119–122.

The first record of the disease for Slovakia (a territory in Czechoslovakia). Symptoms, distribution, losses, and control are described. Agronal-H seed treatment and thiram were effective for control of the disease.

467. DAO, F. 1962. Plantas lasperderas del nematodo causante de los nodulos en las raices *Meloidogyne arenaria thamesi* Chitwood, 1952. Agron. Trop. Maracay 12: 13–33.

Soybean when exposed to the carnation population of *Meloidogyne arenaria thamesi* exhibited light galling, but adult females were not encountered. Only second-stage larvae with the spike tail and no evidence of further development were present. In soybean exposed to the grape population the galling was moderately light and only 3 mature females were present. With the lettuce population the galling was the same and again 3 mature females were present.

468. DARPOUX, H. 1945. [A contribution to the study of diseases of oleaginous plants in France.] Ann. Epiphyt. (n.s.) 11:71–103.

Soybeans were slightly attacked by a species of *Ascochyta* near *A. pisi,* the spherical pycnidia of which showed a peridium 10 μ thick, measured about 150 μ in diameter, and contained hyaline stylospores with a transverse septum, and measured 7–9 $\times$ 2–3 μ.

469. DAS, S. 1967. Virus vector relationships of grapevine fanleaf virus and its nematode vector *Xiphinema index* Thorm and Allen. 1950. Diss. Abstr. 27:1690–1691.

Arabis mosaic virus was transmitted by *Xiphinema index* from *Chenopodium amaranticolor* to soybean in the presence of a Mission seedling.

470. DAUGHERTY, D. M. 1967. Pentatomide as vectors of yeast-spot disease of soybeans. J. Econ. Ent. 60: 147–152.

Microbiological examination of soybean pods artificially inoculated in the greenhouse confirmed that *Nematospora coryli* causes yeast-spot disease in soybeans. The disease normally occurred only in association with feeding by certain species of pentatomids and with mechanical inoculation. Since the organism was not transmitted incidentally through wounds that simulated insect punctures, an intimate association between insect and microorganism was implied. Cage tests showed that *Thyanta custator;* the green stink bug, *Acrosternum hilare;* the brown stink bug, *Euschistus servus;* the dusky stink bug, *E. tristigmus;* the one-spot stink bug, *E. variolarius* (Palisot de Beauvois); and *E. euschistoides* (Vollenhoven) were capable of transmitting the organism that causes yeast-spot disease in soybeans.

471. DAUGHERTY, D. M., and S. B. PLURAD. 1970. Spore development and germination of *Nematospora coryli* (Ascomyceteae: Saccharomycetaceae) a pathogenic yeast. Trans. Missouri Acad. Sci. 4:24–33.

A cultural study of *Nematospora coryli,* the causal agent of yeast-spot disease of soybean.

472. DAVY, R. H. 1942. Further evidence of the fungicidal value of spergon. Plant Dis. Reptr. 26:162–163.

Both spergon and new improved ceresan were found to be effective in the prevention of seed rots and preemergence damping-off in soybean, caused by *Rhizoctonia solani.*

473. DE ARRUDA, H. V. 1952. Analise de uma experiencia sobre variedades de soja [in Portuguese]. Bragantia 12(1/3):65–73.

Soybeans in Brazil are parasitized by two forms of root-knot nematodes closely related to *Meloidogyne incognita.* Twenty-one soybean cultivars were tested for resistance to these forms. N 46-2652, a cultivar considered resistant in the southern United States, was susceptible. Cultivars Palmetto, La. 41-1219, N 45-3799, and Otootan were resistant in field or pot tests.

474. DEBROT, E. A. 1964. Studies on a strain of raspberry ring spot virus occurring in England. Ann. Appl. Biol. 54:183–191.

Raspberry ring spot virus was mechanically transmitted to soybean cultivars Mandarin, Blackhawk, Pennsoy, and Lincoln.

475. DEBROT, E. A., and C. E. BENITEZ. 1966. [Advances in the study of virus diseases of soybean, tobacco, cowpea, French bean, and sweet potato.] 6th Agronomic Conf., Maracaibo, 17–21 March 1966. Rpt. Vol. III. Caracas, Venezuela.

Soybean mosaic is identified and symptoms are described.

476. DEBROT, E. A., and C. E. B. DE ROJAS. 1967. Identification of soybean mosaic virus in Venezuela [English summary]. Agr. Trop. 17:75–76.

The mosaic virus was found on soybeans, particularly on cross between Hernon 237 $\times$ Light Speckled, in an experimental plot in 1964. Data are recorded for virus morphology and transmissibility.

477. DE CARVALHO, T., and O. MENDS. 1958. Diseases of plants in Mozambique [in Portuguese]. Lourence Marques. 84 pp.

Bacterial spot (*Pseudomonas glycinea*) has been noted in the Umbeluzi area. It attacks the cotyledons of seedling plants, but commonly manifests itself when the plants are half grown and progresses until they reach

maturity. Wilt due to *Sclerotium rolfsii* Sacc. also reported from Umbeluzi.

478. DE GUERPEL, H. 1942. [The pests and diseases of soybean.] Rev. Bot. Appl. and Agr. Trop. 17:195–201.

Soybeans in France have so far remained free from diseases. Brief notes are given on the following pathogens reported in Europe and from America: *Heterodera radicicola, H. schachtii, Bacterium glycineum* (= *Pseudomonas glycinea*), mosaic, *Aecicium glycines, Cercospora cruenta, C. kikuchii, Glomerella cingulata, Hypochnus solani, Sclerotium rolfsii, Sclerotinia libertiana* (= *Whetzilinia sclerotiorum*), *Septoria glycines, Peronospora manshurica, Phyllosticta sojaecola, Uromyces sojae* (= *Phakopsora pachyrhizi*), and *Erysiphe communis.*

479. DEIGHTON, F. C., and T. W. TINSLEY. 1958. Notes on some plant virus diseases in Ghana and Sierra Leone. West African Sci. Assoc. J. 4:4–8.

A mosaic probably due to soybean mosaic virus carried in the seed.

480. DEL PRADO, F. A., and N. J. VAN SUCHTELEN. 1955. List of diseases of agricultural and horticultural crops in Surinam [in Dutch]. 25 pp.

Sclerotium rolfsii produces white ray-forming mycelium on the foot of the stem and on the ground. Yellow-brown sclerotia form later. A virus, probably carried by insects, is reported to cause stunting and crinkly leaves.

481. DEMSKI, J. W., H. B. HARRIS, and M. D. JELLUM. 1971. Effects of time of inoculation with tobacco ring spot virus on the chemical composition and agronomic characteristics of soybean. Phytopathology 61:308–311.

Significant effects on the chemical composition and agronomic characteristics of Lee soybean were observed from infection with tobacco ring spot virus up to end of the flowering period, 72 days after planting. Palmitic, linoleic acid proportions of the oil decreased and stearic and oleic acids increased as a result of infection during this period. The total seed oil decreased and total seed protein increased with early inoculation. Virus infection at or before flowering significantly reduced yield and plant height and delayed seed maturity. Early inoculation also affected seed quality and seed weight but did not affect lodging.

481a. DEMSKI, J. W. 1974. Spread of peanut mottle virus in soybeans. Proc. Amer. Phytopath. Soc. 1:37. (Abstr.)

Peanut mottle virus (PMV) is common in southern peanuts. Peanuts are the source of PMV for soybeans when the crops are in proximity. The virus is transmitted from peanuts to peanuts, peanuts to soybean, soybeans to soybeans, and from soybeans to peanuts. When peanuts and soybeans were grown adjacent to each other, greater spread occurred in peanuts (75% infected 3 m from source) than in soybeans (10% infected 3 m from source) over the same time period, suggesting a possible vector preference for peanuts. Several aphid species have been reported as vectors for this virus; however, a negative relationship was evident the past 2 years between winged aphid activity and virus spread. The gradient of infected soybean plants from the virus source is steep. A maximum of 60% infected soybeans immediately adjacent (1 m) to a single row source has been observed and the number of infected plants decreases to less than 1% 50 m from the source. No virus-infected soybeans could be observed beyond 60 m from the source. Soybeans became resistant with age to PMV infection by both natural and mechanical inoculation. A higher percentage of plants became infected when planted in lowlands or shaded areas compared to plants on high ground or in full sunlight.

481b. DEMSKI, J. W. 1974. Single and double virus infection of soybeans. Proc. Amer. Phytopath. Soc. 1:38. (Abstr.)

Soybeans (*Glycine max* (L.) Merrill, cultivars Hampton 266A and Jackson) were inoculated with peanut mottle virus, cowpea chlorotic mottle virus, soybean mosaic virus, and tobacco ring spot virus, singly and in double combinations. Effects on agronomic characteristics of seed and foliage and chemical composition of soybean seed were evaluated. Yield and plant height were significantly reduced by all viruses and virus combinations whereas effect on other agronomic characteristics varied. In general all single and double virus combinations caused an increase in seed total protein and a decrease in total oil in each of two cultivars. The percentage of linoleic, linolenic and palmitic acids decreased whereas oleic and stearic acids increased. With double infections, all effects were additive or less than additive and no synergism was observed.

481c. DEMSKI, J. W., and C. W. KUHN. 1974. Source of peanut mottle virus in soybean and peanut. Proc. Amer. Phytopath. Soc. 1:158. (Abstr.)

Virus disease surveys during the past 3 years have shown that peanut mottle virus (PMV) causes one of the most prevalent virus diseases of soybean in Georgia. The incidence of PMV-infected soybean corresponded closely with the peanut growing area of the state. Further observations revealed that 95% of the soybean fields with PMV were next to peanut fields. Half of the other 5% had volunteer peanut plants. When soybean test plots overlapped land previously planted to peanut or other crops, PMV developed in soybean plot areas only where peanut volunteers developed. Surveys to find PMV in weed hosts were negative. Previous studies have shown that PMV is seedborne in peanut but not soybean. Plants grown from virus-free peanut seed in an isolated field remained free of PMV through maturity, as did soybean

plants grown next to the peanuts. If the primary source of PMV inoculum is outside peanut fields, the proximity of soybean to peanut should not influence PMV development in soybean. Based on the above data, it is proposed that the source of PMV for both soybeans and peanuts is peanut seed. Confirmation of this hypothesis could lead to a virus-free seed certification program that would eliminate a virus disease problem from these two crops.

482. DEMSKI, J. W., and D. W. PHILLIPS. 1974. Reaction of soybean cultivars to powdery mildew. Plant Dis. Reptr. 58:723–726.

Powdery mildew was widespread and locally severe on some soybean cultivars in Georgia in 1972–73. The causal organism was *Microsphaera* sp. Morphological characters of the pathogen are described. Cultivars Bragg, Coble, David, Hardee, Hutton, Jackson, McNair 800, Davis, and N66-1783 were found resistant in field and greenhouse.

483. DEMYERS, D. P. 1972. Effects of dimethylsulfoxide on the production and identification of *Aspergillus flavus* aflatoxin grown on soybean seed.

Aspergillus flavus (ATCC 2221) produced aflatoxins on soybean seed in the presence of dimethylsulfoxide (DMSO) at concentrations of 0, 5, 6, 7, 8, 9, 10, and 25 mg/ml. Fifty g of soybean seed were soaked 30 min. in each DMSO concentration. Seeds were then autoclaved and inoculated with a spore suspension of *A. flavus.* After incubation for 7 days at 24 C, aflatoxins were extracted using 70% acetone and chloroform separation. Spectrophotometric and thin-layer chromatographic analysis indicated that four different aflatoxins were produced at lower DMSO concns. Aflatoxin production was stimulated by DMSO concns of 5–10 mg/ml. Inhibition of total aflatoxin production occurred at 25 mg/-ml DMSO and above. Aflatoxins B_2 and G_2 were inhibited more readily at 10–25 mg/ml DMSO, suggesting the need for additional research on how DMSO affects aflatoxin production. DMSO concns of 5 mg/ml and above also caused loss of pigmentation of conidia.

484. DESJARDINS, P. R., R. L. LATTERELL, and J. E. MITCHELL. 1954. Seed transmission of tobacco ring spot virus in Lincoln variety of soybean. Phytopathology 44:86.

Tobacco ring spot virus was found seed-transmitted by 54–78% of seeds.

485. DEUTSCHMANN, F. 1953. On the purple stain disease of the soybean and the pigment formation by its agent, *Cercosporina kikuchii* [in German]. Phytopath. Z. 20:297–310.

Seeds of a soybean strain imported from America showed a red-violet discoloration resulting from attack by *C. kikuchii,* previously known only in East Asia and America. The fungus is localized in the seed coat until germination begins, then infects the seedling tissues. In culture, the fungus produces the same red-violet pigment that it does in seed coats. Pigment formation depends on an acid reaction of the substrate and the presence of light and oxygen. Pigment deposits, in part crystalline, may be observed on fungal hyphae of young cultures. The pigment, crystallized from an alcoholic extract of mycelium, had a melting point between 208 and 210 C.

486. DE VASCONCELOS, F. A. T. 1964. A contribution to the study of soybean mosaic virus [in Portuguese, English summary]. Anais. Inst. Sup. Agron. Univ. Tec. Lisb. 26:181–223.

The virus was identified on 11 of 22 samples of soybean grown at Oliras, Portugal. *Canavalia ensiformis, Mucuna deeringiana, M. utilis,* and *Vicia narbonensis* were listed as new hosts, and the insects *Megoura viciae, Dactynotus sonchi, Macrosiphum rosae,* and *Aphis craccivora* as new vectors. Other characters of virus are described.

487. DE ZEEUW, D. J., R. A. CRUM, K. M. PAN, and J. FRANKS. 1968. Late season seed treatment trial. Seed and Soil Trt. Newsltr. 10:48–50.

Planted September 8, eight crop plants were used: sorghum, wheat, corn, sugar beets, southern peas, soybeans, white beans, and peanuts. Chemicals used were terrazole, terracoat, captan, arasan, terrachlor-dexon, panoge 1991+arasan. No significant difference between any treatment and control or within any treatment was noted in soybeans.

488. DHINGRA, O. D., and J. B. SINCLAIR. 1972. Variation among isolates of *Macrophomina phaseoli* (*Rhizoctonia bataticola*) from the same soybean plant. Phytopathology 62:1168. (Abstr.)

Abstract of entry 490.

489. DHINGRA, O. D., and J. B. SINCLAIR. 1973. Variation among isolates of *Macrophomina phaseoli* (*Rhizoctonia bataticola*) from different regions. Phytopath. Z. 76:200–204.

Nine isolates of *Macrophomina phaseoli* (= *M. phaseolina*) from soybean were collected from three geographic areas in the United States. Single hyphal tip cultures were studied for variation in cultural characteristics and virulence in causing soybean seedling blight. All isolates varied in growth rate and colony characteristics on potato-dextrose agar at 15, 20, 25, 30, and 35 C. Maximum growth of seven isolates was at 35 C and two at 30 C. Growth rates and sclerotia varied on three media at 25 C. The isolates varied from virulent, through moderately virulent, to weakly virulent. Pycnidia formation and rosetting on inoculated seedlings were recorded for the first time. There was a general correlation between in vitro growth on PDA and virulence of the isolates. The studies were carried out for three generations using single

hyphal tip isolates. There was no variation within any single isolate.

490. DHINGRA, O. D., and J. B. SINCLAIR. 1973. Location of *Macrophomina phaseoli* on soybean plants related to culture characteristics and virulence. Phytopathology 63:934–936.

Single hyphal tip isolations were made from 15 cultures of *Macrophomina phaseoli* (= *M. phaseolina*) isolated separately from roots, stem, petiole, pod, and seed for each of three field-grown soybean plants. Root isolates from each plant caused 80–100% mortality of wound-inoculated seedlings within 10 days or produced severe rosetting on surviving seedlings. Petiole, stem, and pod isolates caused 60–100, 30–60, and 10–20% mortality, respectively. After 4 days, sclerotia from cultures of root isolates ranged from 122–188 × 77–127 μ and stem isolates 84–100 × 60–71 μ. Growth rate and colony type varied among isolates from the same plants, and between isolates from different plants, on different media, and within incubation temperatures (15, 20, 25, 30, and 35 C) on potato-dextrose agar. At 30 C all stem isolates produced fluffy growth, all root isolates were partially fluffy, and the remainder showed appressed growth. Maximum growth was at 35 C for pod and seed isolates and two isolates from root, petiole, and stem; 30 C was optimum for the other three isolates. Each isolate performed consistently in three separate trials.

491. DHINGRA, O. D., J. F. NICHOLSON, and J. B. SINCLAIR. 1973. Influence of temperature on recovery of *Aspergillus flavus* from soybean seed. Plant Dis. Reptr. 57:185–187.

Aspergillus flavus was seedborne in 17 of 20 seed lots of Lee 68 soybean harvested in five states in 1970. Of the 20% recovered at 35 C, 2.7% was internally seedborne and 17.3% was externally seedborne. Recovery of *A. flavus* varied from 0–45% among individual lots. The fungus was recovered from 17 lots at 30 and 35 C, but recovery was negligible at 20 and 25 C. Increased recovery of *A. flavus* was significantly correlated with decreased germination. Germination of Amsoy soybean seed decreased when inoculated with an isolate of *A. flavus* from Lee 68 seed with temperature increase (20 to 35 C). *A. flavus* may be important in evaluating soybean seed quality.

492. DHINGRA, O. D., R. W. SCHNEIDER, and J. B. SINCLAIR. 1973. Cellulolytic and pectolytic enzyme production by virulent and avirulent isolates of *Macrophomina phaseoli* in vitro and in soybean seedlings. 2nd Internatl. Cong. Plant Path. Abstr. 0965.

An abstract of entry 494.

493. DHINGRA, O. D., and J. B. SINCLAIR. 1974. Isolation and partial purification of a phytotoxin produced by *Macrophomina phaseolina*. Phytopath. Z. 80: 35–40.

A phytotoxin(s) was partially purified from culture filtrates of *Macrophomina phaseolina* and from tissues of soybean seedlings inoculated with the pathogen. The phytotoxin(s) from both sources were soluble in water, insoluble in organic solvents, heat stable, and similar in their thin-layer chromatographic behavior. Both had absorption maxima of 255 nm. They moved systemically in soybean seedlings immersed in the solutions. The time until symptoms developed was inversely related to concentration of the toxin(s). Symptoms produced by both sources of toxin(s) were typical of those observed on inoculated seedlings in the later stages of disease development and just prior to their death.

494. DHINGRA, O. D., R. W. SCHNEIDER, and J. B. SINCLAIR. 1974. Cellulolytic and pectolytic enzymes associated with virulent and avirulent isolates of *Macrophomina phaseolina* in vitro and in soybean seedlings. Phytopath. Z. 80:324–329.

Virulent (V) and avirulent (AV) isolates of *Macrophomina phaseolina* were compared for growth and production of pectin methylesterase (PME), polygalacturonase (PG) and cellulase (Cx) in soybean seed extract broth. These were also compared for production of the enzymes and spread in soybean seedlings. There were no differences in dry weights between isolates in vitro at 30 and 35 C, nor in production of PG and Cx at 20, 25, 30, or 35 C. AV produced no PME activity in vitro, but V produced increased PME with increase in temperature. AV progressed 6 cm in 8 days after inoculation but produced no symptoms, while V grew 7 cm in 8 days after inoculation at 35 C. V caused seedling death within 4 days at 30 C. PME activity was higher in V-inoculated plants over controls, but there were no differences in PME activity in AV-inoculated seedlings and controls.

495. DHINGRA, O. D., and J. B. SINCLAIR. 1974. Effect of soil moisture and carbon:nitrogen ratio on the survival of *Macrophomina phaseolina* in soybean stems in soil. Plant Dis. Reptr. 58:1034–1037.

The number of recoveries of *Macrophomina phaseolina* from infected soybean stem pieces, mixed in either of two soil types, decreased with increasing soil moisture from 20–100% moisture-holding capacity (MHC). The fungus was not recovered from stem pieces at 100% MHC for 4 weeks in either soil type. The number of recoveries from stem pieces in soils with high carbon:-nitrogen (C:N) ratio amendments (40 and 80) were less than those of low C:N ratio amendments (10 and 20). Reduction in number of viable sclerotia may be brought about in the field by keeping soil moisture above 60% of its MHC at 30 C or above for 3–4 weeks.

496. DIAB, K. A. 1968. Occurrence of *Heterodera gly-*

cines from the Golden Island, Giza, U.A.R. Nematologica 14:148.

Prematurely yellow and dwarf cowpea plants grown on the Golden Island, about 16 km south of Cairo, were examined. Roots of plants were heavily galled and various stages of *Meloidogyne incognita* were recovered. In addition, numerous lemon-shaped females of *Heterodera glycines* were found attached to the roots. Measurements of length of 30 larvae taken from 6 cysts averaged 432 μ. Opening of the dorsal esophageal gland averaged 4.6 μ behind the spear knobs. Males were less frequent and ranged from 1.00 to 1.30 mm in total body length. *H. glycines* was reported on some varieties of cowpea but this is the first record of *H. glycines* from U.A.R.

497. DIACHUN, S., and W. D. VALLEAU. 1949. Growth and overwintering of *Xanthomonas vesicatoria* in association with wheat roots. Phytopathology 36:277–280.

Xanthomonas phaseoli var. *sojense* grew, multiplied, and produced colonies on wheat, tomato, bean, and soybean roots, the first-named host giving most consistent results.

498. DIAZ, P. C. 1966. *Cercospora kikuchii* on soybean, a new pathogen in Venezuela [English summary]. Agr. Trop. 16:213–221.

First record of the fungus from Venezuela, presumed to be introduced with imported seeds.

499. DICKSON, B. T. 1924. Mosaic studies IV. Phytopathology 14:346. (Abstr.)

Soybean mosaic was found for the first time in Quebec.

500. DICKSON, J. G. 1947. Diseases of field crops. McGraw-Hill, New York. 420 pp.

Includes a chapter on soybean diseases, giving accounts of nonparasitic leaf spot and leaf discoloration; mosaic, bud blight; bacterial blight, wildfire; bacterial pustule; Pythium root rot; downy mildew, powdery mildew; anthracnose; Fusarium wilt; Cercospora leaf spot; Septoria brown spot; sclerotial root, stem, and crown blights, and brown stem rot.

501. DIEHL, W. W. 1946. *Microascus trigonosporus* from soybean. Plant Dis. Reptr. 30:426.

Records the isolation of this fungus from yellow soybean seed that came from Alabama.

502. DIENER, U. L., and N. D. DAVIS. 1966. Aflatoxin production by isolates of *Aspergillus flavus*. Phytopathology 56:1390–1393.

About 80% of *Aspergillus flavus* isolates from groundnuts, cereals, soybeans, and other sources produced aflatoxins.

503. DIMMOCK, F. 1936. Seed mottling in soybeans. Sci. Agr. 17:42–49.

Both environment and heredity have a definite influence on mottling in soybean seed. Selection of strains possessing a high degree of resistance to mottling is suggested as means of reducing this abnormality.

504. DINGLEY, J. M. 1970. Records of fungi parasitic on plants in New Zealand 1966–68. New Zealand J. Agr. Res. 13:325–337.

New record of *Peronospora manshurica* on soybean in New Zealand.

504a. DISTRIBUTION MAPS OF PLANT DISEASES. (Various dates). Commonw. Mycol. Inst., England. (424 maps as of 1966).

Shows worldwide distribution of the pathogens. Some of the causal agents listed for soybeans are: *Diaporthe phaseolorum* var. *caulivora, Nematospora coryli, Peronospora manshurica, Septoria glycines,* soybean mosaic virus, and so on.

505. DO AMARAL, J. F. 1951. Principal diseases of cultivated plants in the state of São Paulo and their control [in Portuguese]. Biologico 17:179–188.

Suggested control in São Paulo, Brazil, of *Cercospora* sp. is to plant early varieties; of *Diaporthe sojae* (= *D. phaseolorum* var. *sojae*) is to use certified seed, rotate crops, and destroy crop residue.

506. DOIDGE, E. M. 1924. A preliminary check list of plant diseases occurring in South Africa. South Africa Bot. Survey Mem. 6. 56 pp.

Downy mildew (*Peronospora manshurica*), leaf blight (*Alternaria* sp.), and leaf spot (*Phoma* sp.) were observed in Natal in 1923.

507. DOIDGE, E. M., A. M. BOTTOMLEY, J. E. VAN DER PLANK, and G. D. PAUER. 1953. A revised list of plant diseases in South Africa. South Africa Dept. Agr. Sci. Bull. 346. 122 pp.

The following are reported from various areas: *Alectra vogelii* (root parasite), *Alternaria* sp. (leaf blight), *Colletotrichum glycines* (= *C. dematium* f. *truncata*) (anthracnose on stems), *Phoma* sp. (leaf spot), *Pseudomonas glycinea* (bacterial blight), *Sclerotium rolfsii* (wilt), and soybean mosaic.

508. DORWORTH, C. E., and C. M. CHRISTENSEN. 1968. Influence of moisture content, temperature, and storage time upon changes in fungus flora, germinability, and fat acidity values of soybeans. Phytopathology 58: 1457–1459.

Soybean seeds were stored with initial moisture contents of 12.1, 14.7, 16.5, and 18.3% and at temperatures of 15, 20, 25, and 30 C and periodically tested for germination percentage, number of surface-disinfected seeds yielding fungi, and fat acidity value (FAV). Germination percentage of beans stored at 15 C remained above 95% for

24 weeks at all moisture contents except 18.3%. With increasing temperature, moisture content, and time, percentage of surface-disinfected seeds yielding *Aspergillus glaucus* increased in all samples with initial moisture contents about 12.1%. *Penicillium* sp., the only other fungus to invade the beans to any extent, increased only in samples with an initial moisture content of 18.3%. In all samples, invasion by storage fungi preceded decrease in germination percentage of beans. In some samples, FAV did not increase significantly even after 100% of the beans were invaded by storage fungi and germination percentage decreased to zero.

509. DOUNINE, M. S. (ed.) 1938. [Virus diseases of plants.] II. Virusnyeboleznirastenii. 240 pp. Moskva:-Vsesoyuzu. Akad. Selskhoz. Nauk Lenina. Virus diseases of the soybean. E. D. Yakimovich, Vol. 2, pp. 226, 277.

510. DRAYTON, F. L. 1926. A summary of the prevalence of plant diseases in the Dominion of Canada, 1920–24. Canad. Dept. Agr. Bull. (n.s.) 71.

Records the occurrence of three soybean diseases.

511. DROPKIN, V. H. 1959. Varietal response of soybeans to *Meloidogyne* — a bioassay system for separating races of root-knot nematodes. Phytopathology 49:18–23.

The host-parasite interaction between soybeans and *Meloidogyne incognita, M. incognita acrita* and *M. arenaria* is presented as a basis for bioassay procedures to distinguish races of root-knot nematodes. Both galling and egg mass production varied as parasite or host changed. Egg mass production seemed independent of gall size. The sex ratio varied with different combinations of host and parasite. A California population of *M. incognita acrita* could be distinguished from a Maryland population by differential behavior on soybean varieties.

512. DROPKIN, V. H., and P. E. NELSON. 1960. The histopathology of root-knot nematode infection in soybeans. Phytopathology 50:442–447.

Histological response to infection was studied in 19 soybean cultivars infected with two populations of root-knot nematodes. Sequence of giant cell development in very young roots of a favorable host cultivar (Richland) is intense cell multiplication about larval head, followed by hypertrophy of cells immediately surrounding the mouth; cell wall dissolution proceeding outward from hypertrophied cells, resulting in multinucleate units — the giant cells. Nuclear division within giant cells is rare. Mature giant cells are classified into four types according to morphology: Type 1 refers to a hypersensitive reaction in which cells immediately around the larva die and no further development occurs. Type 2 cells undergo moderate cell fusion and display unusually great numbers of cell inclusions of peculiar kinds. Type 3 cells are very large, with many nuclei and with a diffuse, highly vacuolated cytoplasm. Types 1, 2, and 3 are always associated with poorly developed parasites with few eggs. Type 4 giant cells consist of large, thick-walled multinucleate units with dense cytoplasm and few cell inclusions. They are associated with rapid parasite growth and abundant egg production. A clue to one aspect of resistance is that cultivar S-100, an unsuitable host, lacks the initial abundant mitoses that accompany giant cell production in a suitable host. Giant cells of type 4 do not develop.

513. DROPKIN, V. H., and P. E. NELSON. 1961. The pathogenicity of *Meloidogyne* spp. (root-knot nematodes), particularly on soybeans. 9th Internatl. Bot. Cong., Montreal, 1959. Rec. Adv. Bot. 1:410–414.

Studies on pathogenicity of *Meloidogyne incognita,* and *M. incognita acrita* on soybeans showed the following effects: hypertrophy and hyperplasia of parenchyma cells and pericycle tissues, hypertrophy of cortex in young roots, failure of vascular cambium in portions of the stele invaded by larvae, abnormal meristems, cell necrosis, and differentiation of tracheids and vessel elements outside the secondary xylem. Also, giant cells were classified into four types.

514. DROPKIN, V. H. 1963. Effects of temperature on growth of root-knot nematodes in soybeans and tobacco. Phytopathology 53:663–666.

Temperature affected the ability of soybeans and tobacco to support growth of *Meloidogyne* spp.; *M. incognita acrita* inoculated on Adams soybean developed to maturity at temperatures between 21.5 and 25 C in greater numbers than at temperatures between 31.5 and 35 C, but more larvae reached maturity at the higher temperatures in cultivar Chief. Equal numbers of *M. arenaria* grew to maturity in one cultivated variety of tobacco (402) and two breeding lines (60-193 and 60-1004) at 25 C, but greater numbers grew to maturity at 35 C in 402 and in 60-193 than in 60-1004.

515. DRUMMOND-GONCALVES, R. 1941. [Mildio em sementes de soja.] O Biologico (São Paulo) 7:238.

Records the occurrence of *Peronospora manshurica.*

516. DUCLOS, L. A., and J. M. EPPS. 1969. Breeding soybeans for resistance to the soybean cyst nematode (*Heterodera glycines*). Agron. Abstr. Madison 1969:5. (Abstr.)

One dominant and three recessive genes appear to determine resistance of three soybean cultivars to *Heterodera glycines.*

517. DUECK, J., and R. J. ZEYEN. 1971. Ultrastructure of soybean leaves affected by systemic toxemia. Phytopathology 61:890. (Abstr.)

Systemic toxemia in young trifoliolate leaves of soybean is caused by toxin(s) produced in older leaves infected by the bacterial pathogen *Pseudomonas glycinea.* Affected leaves can recover from symptoms. Ultrastructural

changes in leaf mesophyll affected by toxemia, and of chlorotic areas adjacent to lesions, were observed in young leaves 8 days after inoculation. Recovered and comparable healthy tissue was sampled at 18 days after inoculation. Mesophyll cells in young healthy tissue had large vacuoles and chloroplasts with well-developed grana and abundant starch grains. Systemically affected leaves had small cells with dense cytoplasm, small vacuoles, and chloroplasts with few lamellae and little starch accumulation. Cells of recovered leaves had large vacuoles, normal chloroplasts with well-developed grana, and extreme starch accumulation similar to comparable healthy cells. The toxin(s) did not cause disruption of cell organelles, but delayed mesophyll cell maturation.

518. DUECK, J., and B. W. KENNEDY. 1972. Physiological characteristics of soybean affected by bacterial toxemia. Proc. 38th Session Canad. Phytopath. Soc. Abstr. 39:29.

Young trifoliolates develop systemic toxemia (stunting and chlorosis) due to toxin produced in older leaves infected with *Pseudomonas glycinea.*

519. DUECK, J., R. J. ZEYEN, and B. W. KENNEDY. 1972. Ultrastructure observations of soybean leaves affected by bacterial toxemia. Canad. J. Bot. 50:529–531.

Trifoliolate leaf tissue with toxemia induced by *Pseudomonas glycinea* had mesophyll cells with dense cytoplasm, little vacuolation, chloroplasts with few lamellae, and reduced starch accumulation. Affected cells resembled very young, healthy mesophyll cells and showed no ultrastructural disruptions. The toxin appeared to act by delaying mesophyll cell maturation and cells that recovered from bacterial toxemia were similar ultrastructurally to mature healthy cells but were smaller.

520. DUECK, J., V. B. CARDWELL, and B. W. KENNEDY. 1972. Physiological characteristics of systemic toxemia in soybean. Phytopathology 62:964–968.

Systemic toxemia in young trifoliolate leaves of soybean is caused by toxin(s) produced in older leaves infected with *Pseudomonas glycinea.* Symptoms were most severe 6–8 days after inoculation, and affected leaves could partially recover. Systemic toxemia could be prevented by steam-killing petioles of inoculated leaves, suggesting that the toxin was translocated in the phloem. Trifoliolate leaves affected by toxemia had a reduced rate of photosynthesis 6–10 days after inoculation, but by the 12th day their rate of photosynthesis was equal to that of healthy leaves. Although leaves recovered in chlorophyll concentration 10 days after inoculation, stunting was permanent.

521. DUKES, P. D., W. H. MARCHANT, and T. J. RATCLIFFE. 1968. Soybean seed decays and seedling diseases, seed- and soil-borne fungi. Amer. Phytopath. Soc. Fungicide and Nematicide Tests, Results of 1967. 23:124–126.

Seed treatment tests were conducted on three soil types to evaluate relative effectiveness of chemicals in controlling soil-inhabiting and seed-borne fungi affecting soybean. Test 1 was on Norfolk sandy loam. It consisted of 30 treatments, 15 with medium-quality seeds and 15 with high-quality seeds. Test 2 on Greenville clay loam consisted of 20 treatments, 16 of which were materials tested in the first test plus the four checks. Test 3 was conducted in late fall on Lynchburg sandy loam and consisted of 11 treatments.

Laboratory assays of seed stocks revealed moderate levels of infestation with *Aspergillus niger, A. flavus,* other *Aspergilli* and *Penicillium* sp., and low levels of infestation with *Rhizopus* sp. and *Fusarium* sp. Similar assays after seed treatment indicated several fungicides were effective in reducing the level of infestation with fungi. The fungicides most effective were captan, panogen 15, panogen PX, difolatan, EP-277, and vitavax. Several seed treatments were effective in reducing seed decays and seedling diseases, thus promoting good seedling emergence and stands. The most effective in tests 1 and 2 were captan, panogen 15, panogen PX, panoram D-31, EP-277, difolatan, vitavax, and thiram + chloroneb. Captan + Mo., panogen PX, difolatan, and vitavax were outstanding under adverse weather conditions in the heavy clay soil. Percentages of abnormal seedlings were only slightly different from the controls, excepting panogen 15 and check + Mo. In test 3, captan, panogen PX, ceresan, M-DB, and EP-346 gave good results with ceresan and panogen giving the best control. Several of the seed treatments tested appeared to be very beneficial in obtaining good stands of soybeans, especially with medium-quality seed under adverse weather conditions.

522. DUKES, P. D., N. A. MINTON, and W. H. MARCHANT. 1969. Soybean lesion (*Pratylenchus brachyurus*), ring nematode *Circonemoides* spp. Amer. Phytopath. Soc. Fungicide and Nematicide Tests, Results of 1968. 24:128.

A nematicide test consisting of six chemical treatments and two checks was conducted on a sandy loam soil infested with root lesion and ring nematodes. The experiment was designed primarily to determine the efficacy of the chemicals in controlling nematodes and effect of the chemicals on soybean plants. The treatments were applied and the soybean seed (cultivar Hampton 266) were sown simultaneously on May 30. Liquid pesticides were injected with one chisel/row, 2 in. to the side of the seed. M 3339 and the hydrocarbon diluent were injected 2 in. below the seed, and M 3342 and fumazone 86 were injected 6 in. below the seed. Granular materials were applied with a Demco applicator in a 12-in. band over the row and incorporated 2–4 in. with a spring-tooth harrow gang. Only ring nematodes were recovered from the soil on July 10 and differences were not statistically significant. On August 9, population levels of all nematodes in the soil were too low to indicate a trend. Fewer

lesion nematodes were recovered from roots of all treated plants than from the check. However, only fumazone 86 and M 3342 were significantly lower than the check. Plants treated with fumazone 86 and M 3342 retained green foliage slightly longer than other treated plants. Yields varied only slightly with no significant differences among treatments. Apparently Hampton 266 plants are tolerant to lesion and ring nematodes, even under serious moisture stress conditions as were present during this experiment.

523. DUMBLETON, L. J. 1954. A list of plant diseases recorded in South Pacific territories. South Pacific Comm. Tech. Paper No. 78. 76 pp.

Records the occurrence of *Sclerotium* sp. at Fiji.

524. DUNIN, M. S. 1959. On some methods of obtaining and applying antisera in phytopathological and entomological researches. Proc. 4th Internatl. Cong. Crop Prot. 1:259–266.

A discussion of work done in the U.S.S.R. at various institutions, including the influence of method of preparing antigens from *Xanthomonas phaseoli* var. *sojense* and cytotoxic serum upon titer and avidity of the obtained sera and use of the serological method in determining the resistance of soybean varieties to cotyledon bacteriosis.

525. DUNLEAVY, J. 1954. Soybean diseases in Iowa in 1953. Plant Dis. Reptr. 38:89–90.

Reports the prevalence of *Pseudomonas glycinea, P. tabaci, Xanthomonas phaseoli* var. *sojense, Diaporthe phaseolorum* var. *batatatis* (= *D. ph. caulivora*), *Phyllostica glycineum* (= *P. sojaecola*), Fusarium blight, *Septoria glycines, Cephalosporium gregatum, Rhizoctonia solani, D. phaseolorum* var., *sojae, Peronospora manshurica, Macrophomina phaseoli* (= *M. phaseolina*), Alternaria leaf spot, bud blight, mosaic, and yellow mosaic virus.

526. DUNLEAVY, J. 1955. Soybean diseases in Iowa in 1954. Plant Dis. Reptr. 39:169–170.

Phyllosticta leaf blight caused by *Phyllosticta sojaecola* affected almost all late-planted soybeans in Iowa. The most severe form of disease as observed in 1953–1954 was leaf blight of seedlings. Unifoliolate leaves were first to show symptoms on which develop V-shaped pale green areas. The areas then turn light brown. Symptoms may appear on first few trifoliolates, but rarely beyond that. Young plants may be defoliated. After initial attack plants recover rapidly by developing new leaves at the apical growing point and lateral branches. Disease damage seems to be a temporary slowing of normal plant development. Stem canker, bacterial blight, and pustule and Fusarium blight were also widespread. Brown stem rot, downy mildew, brown spot, Rhizoctonia root and stem rot, wildfire, and charcoal rot were of minor importance.

527. DUNLEAVY, J. M. 1955. Susceptibility of soybean petioles to attack by *Diaporthe phaseolorum* var. *caulivora*. Proc. Iowa Acad. Sci. 62:104–108.

On basis of artificial inoculation by toothpick tips, it was concluded that infected petioles are unlikely to be an important source of stem canker, but the earliest cankers may result from infected petioles.

528. DUNLEAVY, J. M. 1956. Soybean diseases in Iowa in 1955. Soybean Dig. 16:20.

A survey of soybean diseases in Iowa in 1955 revealed that 95% of the fields were infected by root rot (*Fusarium* sp.), 65% by *Diaporthe phaseolorum* var. *sojae*, 28% by *Pseudomonas glycinea*, 23% by *Cephalosporium gregatum*. *Xanthomonas phaseoli* var. *sojense*, and *Peronospora manshurica* were also prevalent.

529. DUNLEAVY, J. M. 1956. A method for determining stem canker resistance in soybean. Proc. Iowa Acad. Sci. 63:274–279.

Inoculation of the stem tip with toothpick tips containing *Diaporthe phaseolorum* var. *caulivora* of the resistant Harosoy, strain A6K-1040, and the susceptible Hawkeye showed that growth rate was greatest in Hawkeye, less in A6K-1040, and intermediate in Harosoy. It was concluded that stem canker resistance in soybeans was directly proportional to growth rate of pathogen in the stem. Growth of the fungus was retarded at the nodes but was resumed once the node was penetrated. This should be taken into account when comparing fungus growth rates in cultivars with widely different internode lengths.

530. DUNLEAVY, J. M. 1957. Infected roots as a source of stem canker of soybean. Phytopathology 47:8. (Abstr.)

Diaporthe phaseolorum var. *caulivora* was isolated from roots of field-grown soybean plants prior to formation of cankers on stems. Plants with fungus-infected roots matured a few days earlier than noninfected plants and on numerous occasions formed no cankers on stems, although the fungus could be isolated from tap roots and the lower portions of stems just before maturity. Seedlings grown in soil contaminated with the causal organism had infected roots. When such seedlings were grown to maturity, the fungus penetrated the vascular systems of stems and in some cases formed cankers just prior to maturity. Soybean stems killed by the fungus were buried in field soil in the fall. When these stems were recovered in the spring, mature perithecia and viable ascospores had developed. The fungus grew well on steamed field soil, but its lateral growth rate was almost doubled by adding 2% pulverized soybean leaves to the soil. Vertical rate of fungus growth in living plants was much greater

in stems than in roots and increased in stems after pod set.

531. DUNLEAVY, J. M. 1957. A previously undescribed virus disease of soybeans. Phytopathology 47:519. (Abstr.)

In 1955 and 1956, a virus disease similar to bud blight was observed on soybeans. Cross-protection tests and a study of host range showed that it was not tobacco ring spot virus. The virus occurred on *Setaria viridis* and *Melilotus alba* near fields with infected soybean plants. Its host range was the same as that of cucumber mosaic virus, excepting certain members of the Leguminosae, when tested on 28 genera of plants in 12 families. Field symptoms in addition to those described for bud blight are necrosis of pod sutures followed by splitting of green pods along sutures. Angular necrotic areas along margins of pods fall out as the pods enlarge. Under greenhouse conditions, symptoms on soybean could not be distinguished from those produced by tobacco ring spot virus. The virus was transmitted through seed of soybean in three separate tests.

532. DUNLEAVY, J. M. 1957. The grasshopper as a vector of tobacco ring spot virus in soybean. Phytopathology 47:681–682.

Tobacco ring spot virus was transmitted from tobacco to soybean and from soybean to soybean by *Melanoplus differentialis* and by a mixture of *M. mexicanus* and *M. femur-rubrum.* The insects were starved for 4 hr. and then allowed to feed approximately 1 min. on diseased plants before they were transferred to healthy plants. The length of time such grasshoppers fed on healthy soybean plants had a marked effect on percentage of plants infected. The greatest percentage of infected plants was obtained when insects were allowed to take only one bite of leaf tissue. No transmission of the virus was obtained when insects were allowed to feed longer than 0.5 min. Because of feeding habits of grasshoppers and manipulation of the insects on soybean plants necessary to obtain only 1.2% infection, they are not considered an important vector of tobacco ring spot virus.

533. DUNLEAVY, J. M. 1957. Variation in pathogenicity of *Diaporthe phaseolorum* var. *sojae* to soybean. Iowa State Coll. Jour. Sci. 32:105–109.

Diaporthe phaseolorum var. *sojae* is generally considered to be a weak parasite of soybean. Reports by various workers range from the organism's being an aggressive saprophyte to a definite parasite. Two isolates of *D. phaseolorum* var. *sojae* were compared with an isolate of *D. phaseolorum* var. *caulivora* known to be very pathogenic. All isolates were tested on two groups of Hawkeye plants 60 to 80 days old; and on Lincoln plants 100 days old. In all cases one isolate of *D. phaseolorum* var. *sojae* was more pathogenic than the other.

534. DUNLEAVY, J. M. 1958. Studies of seedling blight of soybeans and the etiology of the causal fungus *Diaporthe phaseolorum* var. *caulivora*. Proc. Iowa Acad. Sci. 65:131–145.

Diaporthe phaseolorum var. *caulivora* can cause a seedling rot of soybeans. Infection of cotyledons, stems, and roots was more severe when inoculum was placed in soil above seeds than below. Damage to cotyledons and stems was severe when infected plants were grown in a very humid atmosphere. Average percentage infection where seed was sown adjacent to stems with perithecial initials was 61%.Optimum temperature for lateral growth of the fungus was 25 C and rate of growth was maximum between pH 6 and 7. The fungus formed perithecia on soil and produced viable ascospores in 30–35 days. Optimum water content of soil for lateral growth of the fungus was 25%. Best fungus growth on soil was obtained on soils with high organic matter content. Alternate light and darkness were required for production of perithecial initials, but mature perithecia and viable ascospores developed from perithecial initials in total darkness. The fungus may overwinter on infected soybean stems and as mycelium in soil.

535. DUNLEAVY, J. M. 1959. Survey of races of *Peronospora manshurica* in the United States. Phytopathology 49:537–538. (Abstr.)

A survey of the physiologic races of *Peronospora manshurica,* causal agent of downy mildew of soybean, was conducted. Races of the fungus were isolated from oospore-encrusted soybean seeds from over 200 locations in 21 states. Oospore-encrusted seeds were found in 73% of the bulk, unsorted seed samples received. Highest incidence of such seed from a single location was 20%. Race 8, the predominant race in the northern soybean-producing region, was found in samples from 6 states. Races were rather diverse in remaining states surveyed, and no definite pattern of distribution was observed. Twenty-three pathogenically distinct isolates of the fungus were obtained, including 8 that corresponded to the 8 previously described races. Each of the 23 isolates was tested on 84 soybean cultivars to further determine pathogenicity. All isolates could be characterized by their pathogenicity on each of 11 differential soybean cultivars. Cultivars Mendota, Kanrich, Kanro, and Midwest were resistant, whereas Bansei and Grant were completely susceptible to all isolates. Three introductions were immune to 9 isolates with which they were tested.

536. DUNLEAVY, J. M. 1959. X-ray irradiation of soybean seed as a technique for production of disease-resistant plants. Proc. Iowa Acad. Sci. 66:113–122.

Hawkeye soybean seeds were irradiated with X-rays at dosage levels of 2,500, 5,000, 7,500, 10,000, and 15,000 r. Irradiation had no effect on germination. Plant height 2 weeks after sowing was greatly reduced at 10,000 and 15,000 r, and morphological abnormalities were common. Fertility was greatly reduced at 15,000 r. When seeds

were irradiated at 20,000 to 65,000 r, no plant matured and produced seed when dosage was above 35,000 r. The most obvious effect of high-dosage irradiation of seed was killing of primary leaves and apical meristems. When tested for resistance to *Pseudomonas glycinea* in the first, second, third, and seventh generations after irradiation of seed, progeny from immune plants became increasingly susceptible. When compared in the seventh generation some plants were less susceptible than others. Resistance to *Diaporthe phaseolorum* var. *caulivora* evident in the first generation after irradiation was completely lost by the seventh generation.

537. DUNLEAVY, J. M., C. R. WEBER, and D. W. CHAMBERLAIN. 1960. A source of bacterial blight resistance for soybeans. Proc. Iowa Acad. Sci. 67:120–125.

Incidence of bacterial blight of soybeans was observed from 1953–1959 in 25–72% of the fields examined. A search for an improved source of blight resistance revealed a soybean introduction, P.I. 68708, that was resistant to blight under natural conditions and when inoculated. It was also resistant to brown spot but was susceptible to race 8 of *Peronospora manshurica* as well as to Phytophthora rot. Yield, date of maturity, seed size, seed quality, and lodging resistance of the introduction were comparable to the same characters of cultivar Blackhawk.

538. DUNLEAVY, J. M. 1961. Recent progress in soybean disease research. Soybean Dig. 21(9):10–12.

A popular article briefly describing the research on soybean diseases in the Midwest of the United States.

539. DUNLEAVY, J. M. 1961. Fusarium blight of soybeans. Proc. Iowa Acad. Sci. 68:106–113.

Fusarium orthoceras produced necrosis of succulent root tissues of soybean seedlings and infected tips of lateral roots of older plants. Pods and seeds were most susceptible to fungus penetration after maturity. High relative humidity was necessary for infection of seeds. Maximum stand reduction and yield loss under field conditions were obtained when seeds were sown in *Fusarium*-contaminated soil before rains. In a greenhouse the disease was most destructive when plants were grown in soil at 100% water-holding capacity at 21 C, and was less damaging to plants grown in soil at the same moisture level at 27 C. Seedlings grown in contaminated soil at 100% water-holding capacity at 21 C for three weeks wilted permanently in a few hours when temperature was raised to 33 C whereas plants in noncontaminated soil did not wilt.

540. DUNLEAVY, J. M., and G. SNYDER. 1962. Germination of oospores of *Peronospora manshurica*. Phytopathology 62:8. (Abstr.)

Oospores of members of the Peronosporales germinate with difficulty and some, e.g. *Peronospora manshurica*, have not previously been observed to germinate. Oospores of *P. manshurica* were germinated by washing oospore-encrusted seed coats of soybeans in running tap water for 1 week. Each germinating oospore produced a germ tube, which developed into typical branched mycelium. Oospores were placed in the center of water-agar plates, some of which then were sprayed with a dilute suspension of conidia of *P. manshurica*. Other plates were sprayed later. Conidia were inhibited from germinating in an area around the oospores and size of the area was proportional to the time elapsed between placing oospores on the agar and spraying the agar with conidia. A germination inhibitor has been described for conidia of this fungus and the same inhibitor may be active in preventing oospore germination.

541. DUNLEAVY, J. M. 1962. Stunt disease of soybeans caused by *Corynebacterium* sp. Phytopathology 52:8. (Abstr.)

A nonidentified *Corynebacterium* sp. not previously reported pathogenic to soybeans caused severe stunting of seedlings. The bacteria were transmitted in vascular elements of dormant seed, obtained from eight soybean-producing states. Infected seedlings were extremely spindly and rate of growth was greatly reduced. Frequently, 2-year-old infected seed did not germinate and growing points of seedlings were often killed or seriously damaged. Therefore, spindly branches developed from both cotyledonary buds. Infected plants developed few pods and did not mature normally. As high as 35% seed transmission was observed in 30 commercial seed lots that germinated 90–100%. Plants were most severely stunted when germination occurred at 65–70 F. Symptoms were greatly reduced when infected seed germinated at 95 F. The bacteria produced internal necrosis of the cotyledons of seed near the central vascular bundle. Serological and biochemical tests indicated a relationship to *C. flaccumfaciens*, with several important differences. Cells were smaller and gram variable, indole was produced, gelatin was liquefied, no curd was formed in milk, and nitrates were reduced to nitrites.

542. DUNLEAVY, J. M., and J. F. KUNKEL. 1962. Increased bacterial populations in soybean roots due to phosphorus. Phytopathology 52:730. (Abstr.)

Large populations of a nonidentified *Corynebacterium* sp. were found in roots of certain soybean varieties grown in a high PO_4 (100 ppm P) nutrient solution. Eleven soybean cultivars were rated for cotyledon, leaf, and stem necrosis. Marginal necrosis of cotyledons was evident 7 days after nutrient application. Interveinal leaf necrosis was first observed on Ford and Lincoln 9 days after nutrient application. These cultivars showed complete leaf necrosis, abnormal leaf formation, and bud necrosis after 14 days of treatment. Chippewa, Harosoy, Monroe, Mandarin (Ottawa), and Grant exhibited ex-

tensive necrosis bordering normal, green areas near large veins. Only primary and first true leaves of Flambeau were necrotic. Blackhawk, Chief, and Dorman were comparatively symptom-free. Reduced plant height occurred only in the most susceptible cultivars. Control plants of each cultivar grown in a nutrient solution containing normal levels of PO_4 (5 ppm P) were symptomless. Uniform, replicated samples of roots were assayed for bacterial populations. Roots of Lincoln plants grown in the high PO_4 solution had bacterial populations over 100 times greater than those in roots of Blackhawk plants grown in the same solution or in roots of both cultivars grown in solution containing 5 ppm P.

543. DUNLEAVY, J. M. 1962. Pigmentation of soybean seed coats associated with bacteria. Phytopathology 52:730. (Abstr.)

Seed harvested from soybean plants with severe symptoms of soybean wilt, caused by *Corynebacterium flaccumfaciens,* occasionally were partly stained with the same pigment that occurred in cells of the hila. *C. flaccumfaciens* and a related, nonpigmented species of *Corynebacterium* were consistently isolated from pigmented areas of cream-colored seed coats. Microscopic examination revealed high bacterial populations of pigmented portions of seed coats. Pigmentation usually spread in streaks 0.1–4.0 mm wide, but sometimes formed an irregular halo around the hilum. Pigmentation was most frequently observed on the portion of the seed coat over the radicle of the embryo. Only the outer layer of cells of the seed coat was pigmented. Individual plants were examined and some plants of cultivar Korean had as high as 93% stained seed. Stained and nonstained seed was planted in the field. Stained seed was produced by plants originating from both stained and nonstained seed and there was no difference in amount of staining. No change in pattern or development of pigment in seed coats was observed after the seed matured. Stained seed germinated as well as nonstained seed from the same plant.

544. DUNLEAVY, J. M. 1963. A vascular disease of soybeans caused by *Corynebacterium* sp. Plant Dis. Reptr. 47:612–613.

First symptom of the vascular disease on seedlings is a wilting during the warmest part of the day. A marginal necrosis develops on lower leaves, followed by death of the leaves. On older plants after the flowering stage, small chlorotic spots develop on the leaves under drought or other stress. Leaves do not wilt. Pods are abnormally formed or unfilled. The bacterium is seedborne, primarily a vascular parasite, and has been isolated from vascular systems in leaves, petioles, cotyledon, stem, and roots of infected plants.

545. DUNLEAVY, J. M. 1964. A new bacterial disease of soybeans. Phytopathology 54:891. (Abstr.)

An unreported bacterial disease of soybeans was observed in the field and greenhouse. The first symptom was a translucence of infected areas of leaves. Narrow halos of chlorotic tissue developed at lesion margins as dead tissue became dark brown. Because the dark color of the lesions distinguishes this disease from bacterial blight of soybeans, the name chocolate spot is suggested. The disease was observed most frequently in the field on primary or lower leaves during the first few weeks after seedling emergence. It was more destructive than either bacterial blight or bacterial pustule in greenhouse tests. The bacterium causing chocolate spot can be distinguished from other bacteria that infect soybeans by the following characteristics: It is gram negative and does not produce a yellow or fluorescent pigment in culture. It is positive for starch hydrolysis, gelatin liquefication, nitrate reduction, and catalase and ammonia production. The bacterium is seedborne. Because of similarity of symptoms to brown spot, caused by *Septoria glycines,* considerable care was used to preclude fungus infection during pathogenicity studies. The fungus was present in some lesions produced by bacteria in the field.

546. DUNLEAVY, J. M., J. F. KUNKEL, and J. J. HANWAY. 1966. High population of *Bacillus subtilis* associated with phosphorus toxicity in soybeans. Phytopathology 56:83–87.

High populations of *Bacillus subtilis* were found in roots, stems, and leaves of soybean cultivars that were very sensitive to high concentrations of P in the nutrient solution. The bacterium was observed in leaves of very sensitive varieties prior to appearance of toxicity symptoms from P and was associated with chlorosis and necrosis of leaves and softening of roots. Cultivars tolerant to high P concentrations supported much lower populations than did very sensitive cultivars. The bacterium grew more slowly in root and stem extract broths prepared from tolerant cultivars than in similar extracts prepared from very sensitive cultivars.

Sensitive soybean cultivars grown in high P nutrient solution contained 14 times more P in leaves and 9 times more P in stems than cultivars grown in low-P solution, whereas P content in both leaves and stems of tolerant cultivars was only 4 times greater than in the cultivars grown in a low-P solution. For all cultivars grown in high-P solutions, there was a greater accumulation of N and K in stems than in leaves. The N and K contents of stems of very sensitive plants grown in high-P solution were greater than in tolerant plants; however, N content of leaves of very sensitive plants was lower. Symptoms of toxicity associated with high amounts of P are believed due to utilization by *B. subtilis* of excessive quantities of N, and possibly of other nutrients, with consequent formation of toxicity symptoms, and not necessarily due to accumulation of toxic concentrations of P in leaf cells.

547. DUNLEAVY, J. M. 1966. Factors influencing spread of brown stem rot of soybeans. Phytopathology 56:298–300.

Field soil was contaminated with *Cephalosporium gregatum* and planted to soybeans. The fungus infected more plants, penetrated stems for a greater distance, and decreased seed yield more severely in the second soybean crop than in the first. Incidence of brown stem rot in Iowa soybean fields increased from 6% in 1956 to 53% in 1964. There was a very high positive correlation between percentage of fields in which brown stem rot occurred and number of acres in soybean production. There was a moderately low negative correlation between percentage of fields in which the disease occurred and air temperature, and very little correlation between percentage of fields in which brown stem rot occurred and precipitation during the growing season. This increased incidence of brown stem rot may be ascribed to a gradual shift from a corn-soybean-oats-meadow (or similar) rotation to a corn-soybeans rotation, the practice of bordering corn fields with soybeans, and reduced distances between soybean fields.

548. DUNLEAVY, J. M., D. W. CHAMBERLAIN, and J. P. ROSS. 1966. Soybean diseases. U.S. Dept. of Agr., Agr. Handb. 302. 38 pp.

Symptoms of soybean diseases of fungal, bacterial, viral, and nematode origin, found in United States are described and illustrated. Control measures are recommended.

549. DUNLEAVY, J. M., and R. C. LAMBE. 1966. Soybeans, seedling rots, *Diaporthe phaseolorum* var. *sojae, Diaporthe phaseolorum* var. *caulivora, Fusarium orthoceras.* Amer. Phytopath. Soc. Fungicide and Nematicide Tests, Results of 1965. 21:108.

The objective was to determine the effect of 3 seed protectants on stand and yield of 3 cultivars of soybeans low in germinability, and to determine the effectiveness of two methods of storing soybean seed treated with panogen 15. Treated and nontreated seed was sown in field soil naturally infested with *Diaporthe phaseolorum* var. *sojae, D. phaseolorum* var. *caulivora* and *Fusarium orthoceras.* Soybean cultivars tested were Polysoy, Granger, and Seneca. Seed treated with panogen 15 was stored (1) in sealed polyethylene bags for 2 weeks after treatment and (2) in sealed glass jars for 2 weeks after treatment. All seed protectants applied to seed low in germinability of cultivars Polysoy and Granger produced yields that increased significantly over yields of the controls. This response to seed protectants is believed due in part to the seed used (low in germinability) and to weather conditions. After sowing and prior to emergence, test plots received 4 in. of rain in a 3-day period. For an interval of 15 days following sowing, minimum temperatures recorded were never above 60 F, and lowest temperature recorded during this period was 32 F. Method of storage of panogen 15-treated seed has no effect on stand or yield.

550. DUNLEAVY, J. M., and R. C. LAMBE. 1966. Soybeans, seedling rots, *Diaporthe phaseolorum* var. *sojae, Diaporthe phaseolorum* var. *caulivora, Fusarium orthoceras.* Amer. Phytopath. Soc. Fungicide and Nematicide Tests, Results of 1965. 21:108.

The objective was to determine the effect of 3 seed protectants on stand and yield of two lots of Clark soybeans, one high and one low in germinability, and to determine effectiveness of two concentrations of Morton EP-166. Treated and nontreated seed was sown in field soil naturally infested with *Diaporthe phaseolorum* var. *sojae, D. phaseolorum* var. *caulivora,* and *Fusarium orthoceras.* Seed was sown at the rate of 100 seed per row. Initial germinability of the 2 seed lots was 52% and 92% for lots low and high in germinability, respectively. None of the materials tested increased yields in either seed lot significantly. None of the seed protectants applied to seed lots high in germinability, improved stand significantly. Arasan 75 increased stand of plants from low-germinability seed by 14%. Morton EP-166 had a detrimental effect on seed low in germinability.

551. DUNLEAVY, J. M., and R. C. LAMBE. 1966. Soybeans, seedling rots, *Diaporthe phaseolorum* var. *sojae, Diaporthe phaseolorum* var. *caulivora, Fusarium orthoceras.* Amer. Phytopath. Soc. Fungicide and Nematicide Tests, Results of 1965. 21:109.

The objective was to determine the effect of 12 seed protectants on stand and yield of Harosoy soybeans. Treated and nontreated seed was sown in sterile sand in greenhouse benches and in field soil naturally infested with *Diaporthe phaseolorum* var. *sojae, D. phaseolorum* var. *caulivora,* and *Fusarium orthoceras.* All fungicides tested were ineffective in sand benches. Under field conditions of near normal rain and temperature, the stand was increased significantly over the nontreated control at the 1% level with captan 75, ceresan L, chipcote 75, metasol MMH, memmi, ortho LM, panogen 15, and phygon. None of the fungicides increased yields significantly.

552. DUNLEAVY, J. M., and C. R. WEBER. 1967. Control of brown stem rot of soybean with corn-soybean rotations. Phytopathology 57:114–117.

Nearly complete control of brown stem rot of soybeans was achieved with a 5 years' corn-1 year soybean crop rotation. Percentage of soybean plants infected with *Cephalosporium gregatum* decreased from 100% at beginning of the test to 6% after growth of corn for 5 years on *Cephalosporium*-infested soil. Seed yields from infested plots planted continuously to soybean for 10 years were about 44% of the yield obtained following 5 years of corn. When soybeans were grown after two or three successive corn crops, the highest seed yields were

obtained on infested soil planted to corn for the longest period before soybeans were grown again. Soybean plants grown continuously in infested soil were 18 cm shorter at harvest time than soybeans grown after 5 years of corn. Seed produced by plants in continuous-soybean plots was lighter by 2 g/100 seeds than seed from plants grown after 5 years of corn. Number of seeds produced by plants in continuous-soybean plots was reduced 28% from the number produced after 5 years of corn. In 13 corn-soybean rotations studied, soybean yield loss was due to a 64% reduction in seed number and a 36% reduction in seed size.

553. DUNLEAVY, J. M., and R. C. LAMBE. 1967. Incidence of brown stem rot of soybeans in Iowa. Plant Dis. Reptr. 51:438–441.

Brown stem rot occurred in 55% of 487 soybean fields examined in 1966. The percentage of plants infected in individual fields varied from 11% to 100%. The mean percentage of plants infected per field for the entire state of Iowa was 24%.

554. DUNLEAVY, J. M. 1967. Red clover infected by *Cephalosporium gregatum.* Phytopathology 57:810. (Abstr.)

The only other known host for *Cephalosporium gregatum,* causal agent of brown stem rot of soybeans, is mung beans. During the 1966 disease survey a field was observed in which the soybeans were 90–100% infected by *C. gregatum.* This field had not been planted to soybeans for three successive years, and the previous crop sequence was soybeans, corn, red clover, red clover. Red clover plants growing in another part of the same field were examined. Of 100 dominant plants, 97 had a crown rot. The only symptom in most plants was a light-brown, vascular necrosis confined to the stem and upper tap root. In a few plants the rot had spread well into the tap root. The most severely rotted roots contained small cavities with blackened walls extending from the crown into the tap root for up to 5 cm. *C. gregatum* was isolated from vascular tissue taken from the crowns of diseased red clover plants and these isolates were identical to those obtained from soybean plants. More red clover is grown in southern than in northern Iowa, and brown stem rot of soybeans occurs more frequently in southern than in northern Iowa.

555. DUNLEAVY, J. M., and J. F. KUNKEL. 1968. Inhibition of *Bacillus subtilis* by Amo-1618. Phytopathology 58:456–459.

Amo-1618 (2-isopropyl-4-dimethylamino-5-methylphenyl-1-piperidine carboxylate) inhibited growth of *Bacillus subtilis* in culture. Decrease in mean number of bacterial surface colonies less than 1 mm in diameter was nearly linear on an arithmetic basis from a concentration of 125 to 1,000 ppm Amo-1618 in the medium. Lincoln soybean plants that were very susceptible to injury from high (100 ppm) concentrations of P were less susceptible when sprayed with a solution containing 100 ppm Amo-1618 and grown in a nutrient solution high in P. A drench containing 340 ppm Amo-1618 added to sand in which plants were growing protected the very sensitive soybean plants for 30 days when plants were grown in nutrient solutions high in P. All plants that received an Amo-1618 drench had higher N content in leaves than did control plants. Lincoln plants grown in separate nutrient solutions high and low in P, and which received the Amo-1618 drench, contained 28% (5 ppm P) and 19% (100 ppm P) more N in leaves than Lincoln plants that received no drench. Blackhawk soybean plants (resistant to P-induced injury) that received the Amo-1618 drench contained 21% (5 ppm P) and 6% (100 ppm P) more N in leaves than Blackhawk plants that received no drench.

556. DUNLEAVY, J. M. 1969. Time of brown stem rot symptom expression and percentage infection of plants of eight soybean varieties infected with *Cephalosporium gregatum.* Phytopathology 59:1024. (Abstr.)

The time of symptom expression of 8 cultivars of soybeans grown in the field in soil infested with *Cephalosporium gregatum* was observed for three seasons. Maturity of cultivars ranged from 106–145 days. Stems of 40 plants of each cultivar were examined for internal browning each week from July 1 to plant maturity. The cultivars observed, in order of maturity from earliest to latest, were Acme, Chippewa, Earlyana, Hawkeye, Lincoln, Clark, Wabash, and Dorman. Clark plants consistently had the highest percentage of plants infected (20%) in early July, and were 94% infected at maturity. No Wabash plants were infected in early July, 3% were infected in mid-July, but 29% were infected in late July, when 31% of the Clark plants were infected. Some plants of all cultivars were infected by mid-July. Percentage of plants infected within cultivars for comparable dates was not related to time of bloom or plant maturity. Although plants of the earliest cultivar (Acme) were most resistant, the early Chippewa was nearly as susceptible as Clark, and Earlyana had a higher percentage of plants infected at maturity (88%) than did Dorman (84%) at maturity.

557. DUNLEAVY, J. M. 1969. Consequences of intensive cultural practices on soybean diseases in the Corn Belt. Iowa Agr. Home Econ. Expt. Sta. Spec. Rpt. 64, pp. 35–39.

Concomitant with increased soybean production in the Corn (maize) Belt of the United States the incidence of *Diaporthe phaseolorum* var. *caulivora* increased, *Peronospora manshurica* became widespread, *Cephalosporium gregatum* and Phytophthora rot were found and there was a lowering of soybean seed quality. In Iowa there was a high correlation between incidence of known *Cephalosporium*-infested fields and acreage of soybean.

Primary soybean diseases that affect seed quality are *D. p.* var. *sojae, Cercospora kikuchii, Corynebacterium flaccumfaciens,* tobacco ring spot virus, and soybean mosaic virus. Another factor is root deterioration due to high bacterial populations in the Corn Belt.

558. DUNLEAVY, J. M. 1970. Sources of immunity and susceptibility to downy mildew of soybeans. Crop Sci. 10:507–509.

The disease reaction of 14 races of *Peronospora manshurica,* the downy mildew fungus, was observed on 72 soybean cultivars. Mendota, Kanrich, and a portion of the Kanro plants were resistant to all races studied. Only Bansei was very resistant to all races of the fungus to which it was tested. Cultivars were rated for response to the fungus on a basis of 1 (immune) to 5 (very susceptible). The distribution with respect to rating of the responses of the cultivars to races of *P. manshurica* was determined. Nearly one-third of the cultivar ratings for all race-cultivar combinations were in class 5. Means for the other four ratings were uniformly distributed in classes 1 through 4. Race 8 was most virulent, with 75% of the ratings occurring in classes 4 and 5. In contrast, race 10 was least virulent, with 26% of the ratings occurring in classes 4 and 5.

559. DUNLEAVY, J. M., S. S. QUINIONES, and C. J. KRASS. 1970. Poor seed quality and rugosity of leaves of virus-infected Hood soybeans. Phytopathology 60:883–886.

Mean percentage of germination of 17 seed lots of Hood soybeans collected from 11 states was 64, as opposed to 90 for a control seed lot selected for seed quality and high germination. All Hood seed lots contained some cracked seed, but the control seed lot contained no cracked seed. The mean percentage of cracked seed for all Hood seed lots was 22. A correlation coefficient of — 0.931 was calculated for electrical resistance of leachates from all Hood seed lots with a percentage of seeds with cracks. All field-grown Hood soybean plants grown from all seed lots showed symptoms similar to soybean mosaic, whereas no control plants showed symptoms. A virus was transmitted from field-grown Hood plants to greenhouse-grown Bansei soybean plants and to *Phaseolus vulgaris, Dolichos lablab,* and *Cyamopsis tetragonoloba.* Leaf cells of Bansei infected with the virus from Hood plants contained densely stained circular inclusions, membrane-bound inclusions, and pinwheel inclusions, in areas characterized by the occurrence of numerous vesicles. These structures were not observed in healthy leaf tissue.

560. DUNLEAVY, J. M., and E. E. HARTWIG. 1970. Sources of immunity from and resistance to nine races of the soybean downy mildew fungus. Plant Dis. Reptr. 54:901–902.

A collection of soybean cultivars and soybean plant introductions was observed in the field for 5 years for immunity from *Peronospora manshurica.* Of approximately 300 genotypes evaluated in the field, only eight were never found to be infected. From further evaluation in the greenhouse with races 2, 8, 10, 12, 13, and 16–19, only four were immune to these races.

561. DUNLEAVY, J. M. 1971. Races of *Peronospora manshurica* in United States. Amer. J. Bot. 58:209–211.

A set of 11 soybean cultivars is proposed for the differentiation of races of *Peronospora manshurica*: Pridesoy, Norchief, Mukden, Richland, Roanoke, Illini, S-100, Palmetto, Dorman, Kabott, and Ogden. When these were employed, 15 new races of *P. manshurica,* were found, described, and assigned numbers 9 through 23. Race 8 was encountered most frequently and occurred at 40% of the locations from which seed samples were obtained. Races 1, 2, 10, 12, 18, and 23 occurred at 5–8% of the locations sampled. Race 10 was common in the southern United States. Of 247 soybean seed lots sampled, 73% contained some oospore-encrusted seeds. These ranged 12–26% lighter than healthy seeds. Percentage of oospore-encrusted seeds occurring in seed lots ranged from 0–25%.

562. DUNLEAVY, J. M., and N. V. R. URS. 1973. Isolation and characterization of bacteriophage SBX-1 and its bacterial host, both endemic in soybeans. J. Virol. 12:188–193.

A phage, SBX-1, and its bacterial host, *Xanthomonas* sp. 1, were isolated consistently from roots, internal portions of stems, and leaves of soybean plants. Phage titer in leaves was highly variable. It was very low in seedlings, reached a maximum of 10 PFU/ml of sap after 11 weeks of plant growth, and again dropped to very low levels. SBX-1 was isolated from plants of all 45 cultivars studied, but not consistently from some. Plants of some cultivars also carried *Xanthomonas* sp. 2, which was resistant to infection by SBX-1. The SBX-1 particle has a polyhedral head which contains deoxyribonucleic acid (DNA) of density 1.709. It has an edge-to-edge diameter of 80 mm and a tail length of 112 mm. The tail has a base plant and spikes. This is the first report of the extensive and continuous occurrence of a phage and its host bacterium in plants.

563. DUNLEAVY, J. M., and J. W. FISHER. 1973. Incidence of brown stem rot of soybeans in Iowa in 1972. Plant Dis. Reptr. 57:660–663.

Brown stem rot occurred in 28% of 548 Iowa soybean fields examined in 1972. The mean percentage of plant-infected fields for the entire state was 20.

564. DUNLEAVY, J. M. 1973. Viral diseases. *In* B. E. Caldwell (ed.), Soybeans: Improvement, production, and uses, pp. 505–526. Amer. Soc. Agron., Madison, Wis.

A brief review of recent literature of soybean diseases caused by viruses.

564a. DUNLEAVY, J. M. 1974. Isolation of bacteria from *Peronospora manshurica*. Proc. Amer. Phytopath. Soc. 1:117 (Abstr.)

Xanthomonas phaseoli var. *sojense* causes bacterial pustule disease of soybeans. This bacterium was isolated consistently from leaves of soybean plants infected by race 12 of *Peronospora manshurica,* an obligate fungus that causes downy mildew. The bacterium was isolated by crushing *Peronospora*-infected leaves and inoculating sap to healthy plants. Bacterial pustules appeared in 7–10 days. Bacterial infection was not obtained when healthy leaves were similarly treated. *Peronospora* conidia from six leaflets were washed three times in 10 ml sterile water, crushed, and plated on triplicate sets of dilution plates of trypticase soy agar. Mean populations of *Xanthomonas* of 10×10^4/ml, and of *Pseudomonas ovalis* of 7×10^4/ml were observed. Ten isolates of each bacterium were tested on soybeans. All xanthomonads, but none of the pseudomonads, were pathogenic. Microscopic and plating tests indicated the bacteria were in the fungus cytoplasm. *Xanthomonas* could not be isolated from *Peronospora*-infected leaves earlier than 4 days after inoculation and its numbers increased steadily up to 16 days after inoculation. Both bacteria are believed to be fungus symbionts. Eight additional races of *Peronospora* were studied and pathogenic xanthomonads were isolated from conidia of each race, but xanthomonads isolated from two races formed large, angular, wet lesions instead of pustules. These isolates produced more pectinase in culture than the pustule-forming isolates.

565. DUTTA, P. K. 1959. The effects of previous crops on growth, yield, and certain chemical constituents of two soybean varieties. Diss. Abstr. 19:2707–2708.

Brown spot (*Septoria glycines*) was more than three times as severe on soybean cultivars Ottawa, Mandarin, and Renville after soybean than after maize, oat, wheat, or flax.

566. DWIVEDI, R. S., and B. P. SINGH. 1971. Fungi in the root region of soybean (*Glycine sojae* L.) I. Effect of foliar sprays of gibberellic acid, maleic hydrazide and urea on the rhizosphere mycoflora. Trop. Ecol. 12:257–263.

Soybean plants were sprayed with 50, 100 and 200 ppm of gibberellic acid, maleic hydrazide, and urea to study their effect on rhizosphere microflora. Lowest concentration of gibberellic acid increased the number of fungi/g dry soil, whereas 100 and 200 ppm exerted an inhibitory effect. All concentrations tested for maleic hydrazide inhibited the number of rhizosphere fungi. Urea of 50 and 100 ppm showed no quantitative effect but 200 ppm increased the rhizosphere fungi. Dominance of *Aspergillus niger, A. terreus, Fusarium poae* and *Humicola brevis* increased, whereas dominance of *F. chlamydosporum* and *Aspergillus* sp. decreased in rhizosphere sprayed with gibberellic acid. Dominance of *A. niger, A. terreus, Curvularia lunata* and *F. poae* increased in rhizosphere sprayed with maleic hydrazide. Dominance of *H. brevis* and *F. chlamydosporum* increased in rhizosphere sprayed with 100 and 200 ppm of urea. Dominance of *Cladosporium lignicolum* increased, whereas dominance of *Paecilomyces fusisporus* decreased in rhizosphere sprayed with all the chemicals. Sterile mycelium (white) increased in rhizosphere sprayed with 50 and 100 ppm of all the chemicals but decreased at 200 ppm. *A. flavus* decreased in rhizosphere sprayed with gibberellic acid and maleic hydrazide but showed a marked increase at 200 ppm of urea.

567. DYSART, R. J., and D. W. CHAMBERLAIN. 1960. Studies on transmission of tobacco ring spot virus on soybean and weed suscepts. Plant Dis. Reptr. 44:952–954.

Negative results were obtained in attempts to transmit tobacco ring spot virus from infected to healthy plants with white flies, flea beetles, bean leaf beetle, spotted cucumber beetle, spider mites, and aphids. *Abutilon theophrasti* and *Polygonum hydropiperoides* were susceptible when inoculated mechanically.

568. EDWARDS, D. I. 1962. Biology and host-parasite relations of the stem nematode of onions, *Ditylenchus dipsaci* (Kuhn, 1857) Filipjev. 1936. Ph.D. Thesis, Univ. Illinois. 72 pp.

569. EDWARDS, D. I. 1963. Biology and host-parasite relations of the stem nematode of onion, *Ditylenchus dipsaci* (Kuhn, 1857) Filipjev. 1936. Diss. Abstr. 23: 4058–4059.

Soybean was rated as an excellent host of the onion race of the stem nematode *Ditylenchus dipsaci.* Symptomatology on primary and trifoliolate leaves, cotyledons, and stems of soybean is described for the first time.

570. EDWARDS, D. I., and D. P. TAYLOR. 1963. Host range of an Illinois population of the stem nematode (*Ditylenchus dipsaci*) isolated from onion. Nematologica 9:305–312.

Soybean cultivar Harosoy proved to be an excellent host of the Illinois population of the stem nematode (*Ditylenchus dipsaci*) isolated from onion. Before this host determination, survival of *D. dipsaci* in a commercial onion-set field probably occurred when soybean was used as a rotation crop in the second growing season of a 3-year rotation.

571. EDWARDS, D. I., and D. P. TAYLOR. 1963. Soybean as a host of the stem nematode isolated from onion. Illinois Res. 5(4):16.

The symptomatology of *Ditylenchus dipsaci* on soybean

(cultivar Chippewa) is described. Typical symptoms include: thickened cotyledons with chlorotic areas; wrinkled and puckered leaflets on an occasional trifoliolate leaf; brown streaks on stem area below the leaves; and general retardation of plant growth. A high inoculum level of 5,000 preadult nematodes per 6-in. pot killed all soybean plants after 6 weeks.

572. EDWARDS, D. I. 1967. Soybean nematode problems and research in Illinois. 2nd Soybean Prod. Conf., Urbana, Ill., 1967, pp. 34–36.

A general discussion of soybean-cyst nematode (*Heterodera glycines*) is presented, covering distribution, symptomatology, and control. Other nematode species capable of parasitizing soybean in Illinois include *Pratylenchus alleni* and *Ditylenchus dipsaci.* Five genera were found to be common and widely distributed: *Tylenchus, Helicotylenchus, Paratylenchus, Tylenchorhynchus,* and *Xiphinema.*

573. EDWARDS, D. I. 1969. The soybean cyst nematode. 21st Illinois Custom Spray Operators Training School, Urbana, 1968, pp. 48–49.

A popular article presenting a general discussion of the soybean-cyst nematode (*Heterodera glycines*), covering distribution, losses, symptomatology and races. Control is discussed in terms of crop rotation, resistant cultivars, and nematicides.

574. EDWARDS, D. I. 1969. Nematodes — a factor limiting soybean production. Soybean News 21:3, 5, 6.

A general discussion of nematodes affecting soybeans is presented. Modes of parasitism, symptomatology, and control measures are discussed. *Heterodera glycines, Meloidogyne* spp. and *Pratylenchus* spp. are listed as specific examples.

575. EDWARDS, D. I., and R. A. SIKORA. 1970. An evaluation of nematicides for control of the soybean cyst nematode. 7th Internatl. Cong. Plant Prot., Paris, pp. 196–197. (Abstr.)

Mocap applied at 706 kg/ha and rotox applied at 1,500 kg/ha did not increase soybean yields above those obtained with the resistant cultivar, Custer. Rotox significantly increased the yield of the susceptible cultivar over the nontreated control, while no significant increase was realized with mocap.

576. EDWARDS, D. I., and R. B. MALEK. 1971. Cyst production by *Heterodera lespedezae* on selected legumes. Plant Dis. Reptr. 55:927–929.

Eighteen species of legumes were tested as to host suitability for the Illinois population of *Heterodera lespedezae.* Soybean lines Clark 63, Custer, and NC-55 proved to be nonhosts.

577. EDWARDS, D. I., and R. B. MALEK. 1971. Nonreproduction of *Heterodera lespedezae* on *Heterodera glycines* race differentiating soybean lines. Plant Dis. Reptr. 55:974–975.

Heterodera lespedezae did not reproduce on any of the soybean lines and resistant cultivars used to differentiate races of the soybean-cyst nematode.

578. EDWARDS, D. I., and A. M. GOLDEN. 1971. The occurrence of the lespedeza cyst nematode in Illinois. Plant Dis. Reptr. 55:114.

Cysts collected from a soybean field in Hamilton County, Illinois, were thought to be those of the soybean-cyst nematode. A greenhouse test showed reproduction on Kobe lespedeza but not on soybean. The nematode was identified as *Heterodera lespedezae,* the first report for the state.

579. EDWARDS, D. I. 1973. Soybean cyst nematode — where are we now? 25th Illinois Custom Spray Operators Training School, Urbana, 1973, pp. 106–108.

A popular article, discussing the soybean-cyst nematode (*Heterodera glycines*) in terms of distribution, crop loss, and field symptoms. Use of resistant cultivars, quarantines, crop rotations, and chemicals as control measures are discussed in view of races 3 and 4 of this nematode.

580. Eighth annual report, 1960–1961. Scottish Horticultural Research Institute. 79:1961.

Cherry leaf roll virus was transmitted through 100% soybean seeds.

581. EL-HELALY, A. F., I. A. IBRAHIM, S. H. MICHAIL, and F. R. ABD-EL-AZIZ. 1972. Studies on the damping off and root rot of soybean in Egypt. Phytopath. Medit. 11:202–204.

Rhizoctonia solani, Pythium butleri, and *P. middletonii* caused severe damping-off and root rot. *Macrophomina phaseoli* (= *M. phaseolina*), *Fusarium solani, F. oxysporum, Botryodiplodia theobromae,* and *Cephalosporium* reduced seedling emergence and caused postemergence damping-off and root rot.

582. ELIADE, E. 1960. Contribution to the knowledge of plant diseases in the Botanical Garden, Bucharest [in Russian, German summary]. Lucr. Grad. Bot. 1959, pp. 115–129.

Peronospora manshurica was observed on soybean.

583. ELLIS, M. A., C. C. MACHADO, C. PRASARTSEE, and J. B. SINCLAIR. 1974. Occurrence of *Diaporthe phaseolorum* var. *sojae* (*Phomopsis* sp.) in various soybean seedlots. Plant Dis. Reptr. 58:173–176.

Diaporthe phaseolorum var. *sojae* (*Phomopsis* sp.) was internally borne in 1,002 of 15,200 soybean seeds from six cultivars harvested from six states in 1969, 1971, and 1972. Of 97 seedlots tested, 71 contained internally seedborne *D. ph.* var. *sojae,* variable with harvest year, loca-

tion, and cultivar. When percentage occurrence of *D. ph. sojae* in a single seedlot approached 25% or above, in vitro germination and field emergence were reduced.

584. ELLIS, M. A., M. B. ILYAS, and J. B. SINCLAIR. 1974. Effect of cultivar and growing region on internally seedborne fungi and *Aspergillus melleus* pathogenicity in soybean. Plant Dis. Reptr. 58:332–334.

Fungi of 15 genera were isolated from 26 lots of surface-sterilized soybean seed of 4 cultivars from 5 states. A significantly greater (1% level) percentage of Dare soybean seeds from all regions contained internally borne fungi than the other cultivars. There was a significantly greater percentage of seeds from all cultivars with internally borne fungi from Louisiana (1% level), Mississippi (5% level), and South Carolina (5% level) than from Kentucky and Texas. *Aspergillus melleus* was isolated from Dare seeds produced in Louisiana. *A. melleus* reduced germination of inoculated Amsoy seeds and caused a seedling blight of surviving seedlings, and Koch's postulates were completed.

585. ELLIS, M. A., and J. B. SINCLAIR. 1974. Uptake and translocation of streptomycin by soybean seedlings. Plant Dis. Reptr. 58:534–535.

Soybean seedlings (10 days old) were grown in vermiculite supplied with Hoagland's solution containing either 0, 50, 100, 200, or 300 μg/ml streptomycin sulfate. Assay of treated seedling tissues showed streptomycin was absorbed by roots and translocated up the stems into the first and second trifoliolate leaves of plants grown in 200 and 300 μg/ml. No activity was detected in control plants or in leaves from seedlings grown in 50 or 100 μg/ml. Streptomycin-treated seedlings showed chlorosis and stunting.

586. ELLIS, M. A., M. B. ILYAS, F. D. TENNE, J. B. SINCLAIR, and H. L. PALM. 1974. Effect of foliar application of benomyl on internally seed-borne fungi and pod and stem blight in soybean. Plant Dis. Reptr. 58: 760–763.

Soybean (cultivar Williams) plants were sprayed in the field in Illinois with benlate 50WP: (1) once at mid-flower, (2) once at late-pod, or (3) once at both late-pod and mid-flower stages. Pod and stem blight (*Diaporthe phaseolorum* var. *sojae*) was below controls for all treatments. Percentage of internally seedborne *D. ph.* var. *sojae* and total other fungi from all sprayed plants was less than controls with no significant differences between application time and rates. There was a significant correlation (1% level) among the total internally seedborne fungi, percentage seedborne *D. ph.* var. *sojae* and in vitro germination, but not in percentage germination using a cold test.

586a. ELLIS, M. A. 1974. Effect of streptomycin sulfate seed treatment on internally seed-borne bacteria and germination of soybean seeds. Proc. Amer. Phytopath. Soc. 1:126. (Abstr.)

Soybean seeds (cultivar Lee 68) containing high levels of internally borne bacteria were surface sterilized, then soaked in an aqueous solution of (250 μg/ml for 1 hr.) or dusted with streptomycin sulfate powder (10, 15, 25, 35 mg/20 g seeds). Nontreated and treated seeds were plated on sterile, moist kimpac cellulose pads in 15 cm glass petri dishes at 35 C for 5 days. Percentage germination and number of seeds with bacteria colonies were recorded. Germination in control was 31% with 69% of the seeds decayed by bacteria. Germination of dusted seeds was 74, 80, 91, and 68%, respectively, with 0, 2, 0, and 7% decayed by bacteria. Soaked seeds showed 90% germination and 2% decayed by bacteria. Seed coats were aseptically removed from 10 seeds/treatment, washed with sterile distilled H_2O and placed on Difco streptomycin assay agar seeded with *Bacillus subtilis.* Treated seeds showed inhibition zones at 48 hr. No zones appeared about nontreated seeds. Reduced radicle growth and cotyledonary chlorosis were noted on all treated seedlings.

586b. ELLIS, M. A., M. B. ILYAS, F. D. TENNE, and H. L. PALM. 1974. Reduction of internally seedborne fungi in soybean with foliar applications of benomyl. Proc. Amer. Phytopath. Soc. 1:126. (Abstr.)

Soybean (*Glycine max,* cultivar Williams) plants were sprayed in the field in Illinois with benomyl (benlate 50WP (methyl 1-(butylcarbamoyl)-2-benzimidazolecarbamate) at three rates (⅛, ¼, and ½ lb. a.i./acre): (1) once at mid-flower, (2) once at late-pod, or (3) once at both mid-flower and late-pod stages. Pod and stem blight (*Diaporthe phaseolorum* var. *sojae*) (*Dps*) was below controls for all treatments. Percentage of internally seedborne *Dps* and total other fungi from all sprayed plants was less than controls with no significant differences between application time and rates. There was a significant correlation (1% level) among total internally seedborne fungi, percentage seedborne *Dps* and in vitro germination, but not in percentage germination using a cold test.

587. ELLIS, M. B. 1957. Some species of *Corynespora.* Commonw. Mycol. Inst., Mycol. Papers 65. 15 pp.

Corynespora cassiicola are described on leaves and stems of soybean.

588. ELMILIGY, I. A. 1968. The occurrence of *Heterodera glycines* on *Trifolium alexandrinum* in the United Arab Republic. Nematologica 14:592–593.

Heterodera glycines has been reported for the first time from the United Arab Republic, infecting *Trifolium alexandrinum.*

589. ELMILIGY, I. A. 1970. On some Hoplolaiminae

from Congo and Egypt. Meded. Rijksafac. Landbwet. Gent. 35:1141–1153.

Helicotylenchus dihystera was found in soil around the roots of *Glycine* spp.

590. ENDO, B. Y., and J. N. SASSER. 1957. The effectiveness of various soil fumigants for control of the soybean-cyst nematode. Phytopathology 47:9. (Abstr.)

The soybean-cyst nematode, *Heterodera glycines,* was reported from North Carolina in 1954 but has not been reported as occurring elsewhere in the United States. Information on efficacy of soil fumigants for control of this pest has been lacking. In 1956, the following fumigants at the indicated rates were applied 4 weeks prior to seeding: D-D (1,3-dichloropropene; 1,2-dichloropropane) at 20, 40, and 60 gal./acre; dowfume W-85 (1,2-dibromoethane) at 4.5, 9, and 13.5 gal./acre; methyl bromide (bromomethane) at 1, 2, and 3 lb./100 sq. ft.; nemagon (1,2-dibromo-3-chloropropane) at 3 and 5 gal./acre; telone (1,3-dichloropropene) at 20 and 40 gal./acre. No viable larvae were recovered from plots 1 month after treatment with methyl bromide, D-D (40 or 60 gal./acre), or telone (40 gal./acre). Later, viable nematodes were recovered from these plots; however, numbers recovered were much fewer than those recovered from check plots. For treatments other than W-85 (13.5 gal./acre) and telone (20 gal./acre), white cyst counts were significantly lower than those of controls. In general, there was an inverse correlation between high cyst counts and nitrogen nodule formation.

591. ENDO, B. Y., and J. N. SASSER. 1958. Soil fumigation experiments for the control of the soybean cyst nematode, *Heterodera glycines.* Phytopathology 48:571–574.

Several soil fumigants were evaluated for control of the soybean-cyst nematode, *Heterodera glycines.* Treating infested soil with D-D at 40 and 60 gal./acre, telone at 40 gal./acre, and methyl bromide at 1, 2, and 3 lb./100 sq. ft. increased plant growth and soybean yield. Root nodulation in infested soil was increased by treatment with nematicides. Although nematode populations were greatly reduced by fumigation, differences were no longer significant at harvest time, indicating a rapid build-up of the nematode during the growing season.

592. ENDO, B. Y., and J. N. SASSER. 1958. Fumigation controls soybean-cyst nematode. North Carolina Agr. Expt. Sta. Res. and Farm. 15(4):7.

A popular article. Treating soil infested with *Heterodera glycines* with D-D at 40 and 60 gal./acre, telone at 40 gal./acre, nemagon at 5 gal./acre, and methyl bromide at 1, 2, and 3 lb./100 sq. ft. increased growth and yield of soybeans. Nodulation in infested soil was increased by nematicide treatment. At harvest time, nematode populations had built up again. A brief literature review and history are included.

593. ENDO, B. Y. 1959. Response of root-lesion nematodes, *Pratylenchus brachyurus* and *P. zeae* to various plants and soil types. Phytopathology 49:417–421.

Soybean, cultivar Lee, supported high populations of *Pratylenchus brachyurus.* Lee was also a suitable host for *P. zeae.* In sandy, warm soil, the nematode migrates to maximum distance, but to minimum in Cecil clay. The population of nematode was maximum in Norfolk sandy loam and minimum in Cecil clay.

594. ENDO, B. Y. 1961. Desiccation studies on the soybean cyst nematode, *Heterodera glycines,* under controlled humidity conditions. Phytopathology 51:643. (Abstr.)

An abstract of entries 596 and 599.

595. ENDO, B. Y. 1962. Responses of *Heterodera glycines* to lethal temperatures. Phytopathology 52:9. (Abstr.)

An abstract of entry 598.

596. ENDO, B. Y. 1962. Survival of *Heterodera glycines* at controlled relative humidities. Phytopathology 52:80–88.

Cysts, eggs, and larvae of the soybean-cyst nematode were desiccated at eight relative humidities for various periods. Periodic samplings of cysts in soil showed that cyst contents (viable eggs or larvae) survived 5 months at 3.2, 8.5, 18.8, 37.1, 58.3, 88.8, and 100% RH. Low survival of contents was noted in cysts stored at 0% (over concentrated H_2SO_4) RH for 1 month, but no viable larvae were hatched in cysts stored 2 months. Viable larvae were recovered from cysts in soil stored at 3.2% RH for 5 months but not for 11 months. Active larvae were found in cysts from all other humidities. When cysts were stored free of soil, viable larvae were recovered from cysts stored at 0% RH for 1 month but not for 2 months. Viable larvae were found in free cysts stored at 3.2% RH for 2 months but not for 3 months. Active and healthy larvae were recovered from cysts stored up to 6 months at all other humidities. Eggs on cover glasses in desiccator jars were sampled periodically; viable larvae were recovered up to 4 days at humidities of 0, 3.2, and 8.5%, and up to 8 days at 18.8, 37.1, 58.3, and 88.8%. Viable larvae were recovered from eggs stored at 100% RH up to end of test (16 days). Studies on desiccation of free larvae showed survival at the following maximum lengths of exposure at the various humidities; 6 min. at 0%; 9 min. at 3.2%; 10 min. at 8.5, 18.8, and 37.1%; 15 min. at 58.3%; 1 hr. at 88.8%; and over 1 hr. at 100%.

597. ENDO, B. Y. 1962. Anatomical studies of soybean roots artificially inoculated with *Heterodera glycines.* Phytopathology 52:731. (Abstr.)

Root samples of soybean seedlings (cultivar Lee) taken 6, 9, 10, 12, and 15 days after inoculation were fixed

with CRAF III and stained with safranin and fast-green. Infected roots typically showed necrosis near the nematode lip region with cellular discoloration advancing through several layers of cortical tissue. Developing giant cells occurred primarily internal to the endodermis. Granular cytoplasmic changes occurred in a number of cortical cells adjacent to nematode feeding sites, but such cells were associated with a more highly developed giant cell system internal to the endodermis. Giant cell systems observed through serial cross sections apparently develop by a stimulating process in which adjacent cells enlarge, reveal cytoplasmic changes, and show enlargement of nuclei. Individual cells of pericyclic and phloic tissue were observed as they were incorporated into the giant cell system. Older, enlarged giant cells apparently contain fragments of cell walls which were possibly burst by mechanical pressure of distending giant cells.

598. ENDO, B. Y. 1962. Lethal time-temperature relations for *Heterodera glycines*. Phytopathology 52:992–997.

Hot-water treatments were used to determine the lethal time-temperature relations of the soybean-cyst nematode. In three series of tests, larvae and eggs, free eggs, and free larvae were exposed for various periods in constant-temperature water baths at 145–110 F at 5° intervals. Special, thin brass containers with a centrally located hemispherical well and a cover were used to submerge the nematode samples. Viability of larvae in cysts and in eggs was determined 10 days after treatment and selected samples were examined for infectivity of soybean plants. Minimum lethal exposures from three series of tests were (A) larvae in cysts: 145°, < 1 sec.; 140°, 10 sec.; 135°, 40 sec.; 130°, 2 min.; 125°, 8 min.; 120°, 30 min.; 115°, 4 hr.; and 110°, > 8 hr. (B) free eggs: 145° < 1 sec.; 140°, 10 sec.; 135°, 1 min.; 130°, 4 min.; 125°, 8 min.; 120°, 25 min.; 115°, 4 hr.; and 110°, > 4 hr. (C) free larvae: 140°, < 1 sec.; 135°, 5 sec.; 130°, 10 sec.; 125°, 1 min.; 120°, 2 min.; 115°, 15 min.; and 110°, 30 min. Similar time-temperature responses were found for all nematode stages tested, with a correspondingly lower minimum lethal and maximum survival exposure for free larvae.

599. ENDO, B. Y. 1962. Studies on the desiccation of the soybean-cyst nematode under controlled relative humidity conditions. Tennessee Farm and Home Sci. Prog. Rpt. 42, pp. 12–13.

Results indicate that desiccation under normal storage conditions greatly reduces nematode populations on infested plant parts and equipment. However, eradication appears very difficult under normal fluctuating atmospheric conditions. It demonstrated for the first time the precise roles of cyst and soil in relation to survival of the soybean-cyst nematode. The results can be summarized by referring to survival of larvae in eggs in cysts in terms of months, survival of larvae in free eggs in terms of days, and survival of larvae in terms of minutes.

600. ENDO, B. Y. 1963. Penetration, infection, and development of *Heterodera glycines* in soybean roots and relative anatomical change. Proc. Assoc. So. Agr. Workers, Inc., 60th Ann. Conv., Memphis, Tenn., 1963, p. 284. (Abstr.)

An abstract of entry 601.

601. ENDO, B. Y. 1964. Penetration and development of *Heterodera glycines* in soybean roots and related anatomical changes. Phytopathology 54:79–88.

Anatomical changes in soybean roots (cultivar Lee) resulting from infection by the soybean-cyst nematode (*Heterodera glycines*) were observed and correlated with developmental stages of the nematode. Primary root samples (six replicates) were taken daily up to 6 days after inoculation, at 3-day intervals up to 30 days, and at 40 days. Within 1 day, second-stage larvae penetrated cortical tissue and were detected with stylets inserted in cortical, endodermal, or pericyclic cells. Pierced cells showed an interaction with larvae by cellular hypertrophy, cell wall dissolution, and clumping of nuclei from contiguous cells. In 2–6 days, syncytia were well established in contact with second- and third-stage larvae, especially where infection occurred at or near protoxylem poles. Syncytial development opposite protophloem tissue was limited. In 9 days, syncytia associated with males showed signs of degeneration, whereas syncytia associated with females appeared healthy up to and beyond egg deposition at 21 days. Secondary phloem and xylem were restricted by syncytial development in the secondary cambial region. During the period of reduced feeding by matured females, parenchymatous cells grew invasively into regions once occupied by degenerated and shrunken syncytia.

602. ENDO, B. Y. 1965. Entry and development of *Heterodera glycines* Ichinohe in susceptible and resistant soybeans. Nematologica 11(1):36. (Abstr.)

An abstract of entry 603.

603. ENDO, B. Y. 1965. Histological responses of resistant and susceptible varieties and backcross progeny to entry and development of *Heterodera glycines*. Phytopathology 55:375–381.

Comparative observations were made on soybean-cyst nematode entry and development in soybean (Lee and Peking), and in the resistant backcross progeny. In Lee soybeans, progressive development of male and female nematodes was associated with host tissue changes and syncytial development. At termination of nematode feeding and syncytial collapse, rejuvenated parenchymatous cells invaded regions surrounding syncytia. A very high degree of resistance to nematode development was observed in Peking soybeans. Syncytia were formed within

2–3 days after inoculation and revealed cellular changes similar to early reactions in susceptible tissues of Lee soybeans. However, many syncytia degenerated within 5 days after inoculation and were associated with dead second-stage larvae. Rejuvenated parenchyma cells had invaded regions of the roots vacated by degenerate syncytia within 8–10 days after inoculation. In roots 10 days and older, and up to 31 days, necrosis was restricted in the periphery of the stele and to regions in the cortex that were invaded and stimulated by infective larvae. Lee × Peking BC_2F_4 soybean roots showed a slightly lower degree of resistance to nematode development than the resistant parent Peking. Syncytia were stimulated by larvae but host response was variable. Some nematodes deteriorated as second-stage larvae within a few days after penetration and were associated with degenerate syncytia, whereas other larvae continued development in the third stage. A limited number of nematodes developed to mature males and into adult females embedded in root tissues. Syncytial development was closely related to degree of nematode growth. Necrotic tissues consisting of degenerate syncytia were similar to reactions found in Peking soybeans.

604. ENDO, B. Y. 1967. Comparative reproduction of *Pratylenchus brachyurus* and *P. zeae* in corn and soybean varieties Lee and Peking. Nematologica 13:140–141. (Abstr.)

An abstract of entry 605.

605. ENDO, B. Y. 1967. Comparative population increase of *Pratylenchus brachyurus* and *P. zeae* and in soybean varieties Lee and Peking. Phytopathology 57: 118–120.

Lee and Peking soybean cultivars and corn were inoculated with *Pratylenchus brachyurus* and *P. zeae* to determine their relative susceptibility to root lesion nematodes. After a 3-month infection period, nematode populations varied according to inoculum treatment, but such differences were not present after 7 months. With both infection periods, *P. brachyurus* reproduced more rapidly than *P. zeae* on Lee soybeans. No differences in increase of populations of the two species of root lesion nematodes were noted between Lee and Peking when plants were assayed on a "per gram of root" basis. However, in nematode assays based on whole roots and infested soil, higher populations of *P. zeae* were found on Lee than on Peking. No varietal differences were found with *P. brachyurus*. In another experiment, Golden Bantam corn was compared with the soybean cultivars. In general it was found that *P. brachyurus* multiplied more rapidly on the soybean cultivars and that *P. zeae* multiplied more rapidly on corn. Higher populations of *P. brachyurus* were found on Peking than on Lee soybeans. Factors for resistance to the soybean-cyst nematode in Peking do not confer similar resistance to root lesion nematodes. Peking soybeans were as susceptible, or more susceptible, to these root lesion nematodes as Lee soybeans.

606. ENDO, B. Y., and J. A. VEECH. 1969. Comparative enzyme histochemistry in root knot resistant and susceptible soybeans. J. Nematol. 1:285–286. (Abstr.)

A comparison was made of histochemical and morphological responses of susceptible (Lee) and resistant (Delmar) soybeans to infection by *Meloidogyne incognita acrita*. The activity of certain oxidoreductive, hydrolytic, and oxidative enzymes of the susceptible cultivar significantly increased, primarily within the syncytium. Initially, galling response to infection was similar in both susceptible and resistant plants, i.e., slight galling was observed prior to microscopic detection of syncytia. With some exceptions, differences between susceptible and resistant responses were not apparent until several days after inoculation. During the first few days both cultivars showed a similar, slight increase of host enzyme activity at the nematode feeding site. Host enzyme activity in susceptible plants continued to increase with time, a response not observed in resistant plants. By the time syncytial induction occurred in the susceptible host, the most common resistant host response was cell necrosis. Often, after inducing necrosis, the nematode migrated to non-necrotic, resistant host cells and commenced feeding; these cells subsequently became necrotic.

Typically, the resistant host response is characterized by extensive necrosis, whereas the susceptible response is characterized by increased enzyme activity at the nematode feeding site. Since enzyme activity is not stimulated significantly at the feeding site of the nematode in resistant plants, extensive syncytia did not develop, preventing nematode maturation. Conversely, in the susceptible host, enzyme activity is greatly increased, syncytia develop, and the nematode completes its life cycle. The previously noted exceptions to the above description of resistant host response include occasional observations of intense stimulation of enzyme activity, development of extensive syncytia, and concomitant nematode maturation. We interpret those exceptions to mean that a few nematodes are successful in stimulating resistant host metabolism to produce syncytia. This interpretation is consistent with observations of other investigators that a few nematodes will complete their life cycles on a resistant host. However, incidence of this is greatly reduced in the resistant cultivar (Delmar) compared with the susceptible cultivar (Lee).

607. ENDO, B. Y., and J. A. VEECH. 1969. The histochemical localization of oxidoreductive enzymes of soybeans infected with the root-knot nematode *Meloidogyne incognita acrita*. Phytopathology 59:418–425.

Five dehydrogenases and two diaphorases were histochemically localized in fresh sections of Lee soybean roots infected by the root-knot nematode *Meloidogyne incognita acrita*. In general, responses of the seven oxi-

doreductases to infection were similar. High activity along the path of penetration indicated that second-stage larvae activated that host's enzyme systems prior to establishing a permanent feeding site. Syncytia, induced by extensive feeding by the nematode, showed more intense oxidoreductase localization than surrounding tissues. The initiation of hyperplasia and increase in localized oxidoreductase activity were observed at the posterior zone of parasitic second-stage and preadult nematodes. Observations of host response adjacent to anus of larvae indicated that excretory products of nematodes are involved in initial stimulation of these enzymes. Hyperplasia of host tissue at posterior zone of the nematode followed enzyme stimulation. This sequence resulted in formation of a tissue resembling lateral root primordia. The oxidoreductases localized were: malate, isocitrate, succinate, glucose-6-phosphate, 6-phosphogluconate dehydrogenases, and NAD and NADP diaphorases.

608. ENDO, B. Y. 1970. Nucleic acid synthesis at infection sites of soybeans invaded by the soybean cyst nematode. Phytopathology 60:1014. (Abstr.)

An abstract of entry 610.

609. ENDO, B. Y., and J. A. VEECH. 1970. Morphology and histochemistry of soybean roots infected with *Heterodera glycines*. Phytopathology 60:1493–1498.

Morphological and histochemical observations were made on roots of susceptible (Lee) and resistant (Pickett) soybeans infected with the soybean-cyst nematode, *Heterodera glycines*. Certain host enzymes were localized near the nematode stylet during penetration and migration of infective larvae. Increased enzyme activity was observed in syncytia of both susceptible and resistant hosts during early stages of disease development. As syncytia development progressed in the susceptible host, high enzyme levels were demonstrated in the dense cytoplasm. In the resistant host, syncytia were initiated and showed a slight increase in enzyme activity, but the syncytia shortly became necrotic and deteriorated. Cortical necrosis was common in both susceptible and resistant hosts as a result of intracellular migration of larvae. Enzyme stimulation and necrosis associated with cyst nematode infections are discussed in relation to similar studies previously reported for root-knot infections of the same host.

610. ENDO, B. Y. 1971. Synthesis of nucleic acids at infection sites of soybean roots parasitized by *Heterodera glycines*. Phytopathology 61:395–399.

Syncytia induced in soybean roots by the soybean-cyst nematode are characterized by presence of numerous enlarged nuclei in a mass of dense cytoplasm. Observations of infected root sections made during various stages of nematode development show that syncytial nuclei are relatively quiescent in terms of deoxyribonucleic acid (DNA) synthesis. However, tritiated thymidine was incorporated in nuclei of syncytia located in both the cortical and vascular regions of infected roots. A primary site of DNA synthesis in a developing syncytium was at the leading edge of the syncytium. Nuclei of cells in this transitional zone showed high ^{3}H-methylthymidine uptake, signifying sites of active DNA synthesis.

611. ENDO, S. 1963. Protecting food crops from diseases [in Japanese]. Tokyo. 693 pp.

Taxonomic notes and suggestions for control of: *Ascochyta sojaecola; Cercospora sojina,* frog-eye; *C. kikuchii,* purple stain; *Corticium rolfsii,* sclerotial blight; *Corynespora* sp.; *Cuscuta sojagena; Diaporthe phaseolorum* var. *sojae,* pod and stem blight; *Elsinoe glycines;* Sphaceloma scab; *Fusarium oxysporum* f. *tracheiphilum,* blight and pod rot; *Glomerella glycines,* anthracnose; *Macrophoma mame; Macrophomina phaseoli,* charcoal rot; *Mycosphaerella sojae,* brown leaf spot; *Ophionectria sojae,* basal stem rot; *Pellicularia sasakii; Peronospora manshurica,* downy mildew; *Phakopsora pachyrhizi,* rust; *Pleosphaerulina americana; Pseudomonas glycinea* var. *japonica,* bacterial blight; *Sclerotinia sclerotiorum,* Sclerotinia rot; *Septogloeum sojae; Septoria glycines,* brown spot; *Xanthomonas phaseoli* var. *sojense,* bacterial pustule; and mosaic.

612. ENYINNIA, T., and J. K. SPRINGER. 1974. Effect of fungicidal seed treatment on emergence of *Diaporthe*-infected soybeans. Phytopathology 64:580. (Abstr.)

Soybeans (cultivar Clark 63) infected with *Diaporthe phaseolorum* var. *sojae* were treated with benomyl (benlate 50WP), cleary 3336 50WP, mertect 360 (TBZ 60WP), thylate (arasan 65 WP) each at 2 oz./bu. of seed, or 5% clorox (NaOCl). Also, thylate was combined with each chemical. Greenhouse and field plantings were made and percentage of seedling emergence recorded. Benlate produced 78% and 91% healthy seedlings in greenhouse and field, respectively. Similarly, cleary 3336 produced 76% and 87%; mertect, 78% and 79%; thylate, 81% and 90%; clorox, 74% and 74%; benlate plus thylate, 80% and 88%; cleary 3336 plus thylate, 79% and 87%; mertect plus thylate, 75% and 94%; and clorox plus thylate, 78% and 90%. However, only 67% and 70% of control plants emerged in greenhouse and field, respectively. Seedling emergence was generally higher where thylate was used. The systemic fungicides were not better than the standard protectant thylate, and the clorox dip was found unsatisfactory. Seedling emergence in the field was consistently higher than in the greenhouse.

613. EPPS, J. M., and L. A. FISTER. 1941. Root-knot nematode in parts of west Tennessee. Plant Dis. Reptr. 25:510–512.

Root-knot nematodes were found associated with several crops, including soybeans.

614. EPPS, J. M., J. C. PATTERSON, and I. E. FREEMAN. 1951. Physiology and parasitism of *Sclerotium rolfsii.* Phytopathology 41:245–256.

Soybean quickly becomes resistant to *Sclerotium rolfsii* as the plant passes the seedling stages. The paper primarily deals with survival of the pathogen on wheat seeds and soil under different conditions, effect of soil temperatures and moisture on its activity in soil, infection of wheat seeds, and host range to dicotyledons and monocots. Perfect stage of the pathogen is produced on onion extract agar.

615. EPPS, J. M. 1957. Soybean cyst nematode found in Tennessee. Plant Dis. Reptr. 41:33.

The soybean-cyst nematode (*Heterodera glycines*) was found in a soybean field near Ridgely, Tennessee, the second time the nematode has been reported in the United States.

616. EPPS, J. M., and A. Y. CHAMBERS. 1958. New host records for *Heterodera glycines,* including one host in the Labiatae. Plant Dis. Reptr. 42:194.

The host range of the soybean-cyst nematode, *Heterodera glycines,* is extended as a result of a series of tests in the greenhouse. The new hosts reported include hemp sesbania (*Sesbania macrocarpa*); white lupine (*Lupinus albus*), and henbit deadnettle (*Lamium amplexicaule*). The last-named is a member of the Labiatae and is the first host reported outside the Leguminosae.

617. EPPS, J. M. 1958. Viability of air-dried *Heterodera glycines* cysts. Plant Dis. Reptr. 42:594–596.

In two experiments, no viable larvae of the soybean-cyst nematode, *Heterodera glycines,* were found in cysts after a 1-month storage period in seed bags. In one experiment live larvae were found in cysts stored with seed for only 1 month, and these produced white females on roots of potted plants. There were no viable larvae found in this experiment after storage for 2 and 3 months.

618. EPPS, J. M., and A. Y. CHAMBERS. 1959. Mung bean (*Phaseolus aureaus*), a host of soybean cyst nematode (*Heterodera glycines*). Plant Dis. Reptr. 43:981–982.

Mung bean was reported as a new host for the soybean-cyst nematode.

619. EPPS, J. M. 1960. Evaluation of crop rotations and soil fumigation for controlling the soybean cyst nematode. Phytopathology 50(9):635. (Abstr.)

In 1957 cotton was planted in four plots in a field heavily infested in 1956 with soybean-cyst nematodes (*Heterodera glycines*), and soybeans were planted in four adjacent plots. Soybeans were planted in all plots in 1958 and average yields were 33.9 and 25.3 bu./acre, respectively. In 1959, four plots planted to soybean in 1956 and 1957, and to cotton in 1958, had average yields of 33.1 bu./acre, compared with average yields of 24.0 bu. for four plots in soybeans in 1956–1959. Treatment of other plots in the same field planted in soybean the three previous years with 0.5 gallon of 1,2-dibromo-3-chloropropane increased yields from 21.5 bu. to 27.8 bu./acre in 1958, and from 22.6 to 28.2 bu. in 1959. Thus, increases in yields from rotation with cotton for 1 year and from soil fumigation were about equal. Soybean-cyst nematode populations in these plots increased more rapidly on soybeans grown after fumigation or rotation than on soybeans grown after soybeans.

620. EPPS, J. M., and A. Y. CHAMBERS. 1962. Soybean cyst nematode — symptoms, life cycle, spread, host range, research on control. Tennessee Farm and Home Sci. 41:13–15.

A popular article discussing the soybean-cyst nematode with special emphasis on the nematode and research and progress to develop control measures.

621. EPPS, J. M., and A. Y. CHAMBERS. 1962. Effects of seed inoculation, soil fumigation, cropping sequences on soybean nodulation of soybeans grown in soybean cyst nematode infested soil. Plant Dis. Reptr. 46:48–51.

Reduced nodulation of soybeans is frequently associated with infection by the soybean-cyst nematode, *Heterodera glycines,* in Tennessee. In experiments near Ridgely during 1957–1959, addition of inoculum of *Rhizobium japonicum* to planting seed did not significantly increase nodulation in soil heavily infested with the nematode and cropped to soybeans the preceding season. In two of six soil-fumigation experiments in 1958 and 1959, nodulation was significantly increased by fumigation. In 1958, highly significant increases in nodulation were obtained with row applications of granular dibromochloropropane at 1, ¾, and ½ gal./acre at planting and ½ and ¼ gal./acre side-dressed 3 weeks after planting. In 1959, broadcast applications of D-D mixture at 40 gal./acre and D-EDB mixture at 12 gal./acre gave highly significant increases in nodulation while ethylene dibromide at 4½ gal./acre gave significant increases. Nodulation did not differ significantly from controls in four other soil fumigation experiments. Data recorded in 1959 and 1961 from similar 4-year cropping sequence experiments set up in 1956 and 1958 showed significant increases in nodulation in a cropping sequence of soybeans, soybeans, cotton, and soybeans as compared with continuous soybeans for 4 years. Nodulation was significantly decreased in a cropping sequence of soybeans, cotton, soybeans, and soybeans in comparison with 4 years of soybeans.

622. EPPS, J. M., and A. Y. CHAMBERS. 1962. Nematode inhibits nodules on soybeans. Crops and Soils 15:18.

A popular article, reviewing the effects of seed inoculation, fumigation, and rotation with nonhost crops.

623. EPPS, J. M., and A. Y. CHAMBERS. 1962. Effects of seed inoculation, soil fumigation, and cropping sequences on nodulation of soybeans grown in soybean-cyst-nematode-infested soil. Phytopathology 52:9. (Abstr.)

In experiments near Ridgely, Tenn., during 1957–1959, addition of inoculum of *Rhizobium japonicum* to seed did not significantly increase nodulation of Lee soybeans in soil heavily infested with the soybean-cyst nematode (*Heterodera glycines*) and cropped to soybeans the preceding season. In 1958, highly significant increases in nodulation were obtained with row applications of a granular formulation of 1,2-dibromo-3-chloropropane at 1.0, 0.75, and 0.5 gal./acre at planting and with 0.5 and 0.25 gal./acre side-dressed 3 weeks after planting. In 1959, broadcast applications of liquid formulations of a mixture of 1,3-dichloropropene plus 1,2-dichloropropane at 40 gal./acre and a mixture of 1,3-dichloropropene plus 1,2-dibromoethane at 12 gal./acre gave highly significant increases in nodulation, whereas 1,2-dibromoethane at 4.5 gal./acre gave significant increases. Nodulation did not differ significantly from controls in four other soil fumigation experiments. In 1959 and 1961, data from similar 4-year cropping sequence experiments set up in 1956 and 1958 showed highly significant increases in nodulation in a cropping sequence of soybeans, soybeans, cotton, and soybeans. In contrast, nodulation was significantly decreased in a cropping sequence of soybeans, cotton, soybeans, and soybeans, compared with 4 years of soybeans.

624. EPPS, J. M. 1963. Effects of sugar treatments on the viability of eggs and larvae in *Heterodera glycines* cysts, and larvae and adults of other nematode species. Plant Dis. Reptr. 47:180–182.

All eggs and larvae of the soybean-cyst nematode in cysts were not killed in sugar solutions or sugar-soil mixtures, nor were individuals of other plant-parasitic nematodes killed by the treatments. Tomato plants set in soil containing concentrations of 1% or more sugar wilted, and most of the plants died. Soybean seed planted in sugar-soil mixtures of more than 2.5% concentration failed to emerge. Therefore, control of the soybean-cyst nematode with sugar is not considered effective or practical.

625. EPPS, J. M., and A. Y. CHAMBERS. 1963. Influence of planting date on yield of soybeans in fumigated and untreated soil infested with *Heterodera glycines*. Plant Dis. Reptr. 47:589–593.

Manipulation of the planting date of soybeans to reduce yield losses caused by the soybean-cyst nematode, *Heterodera glycines*, was found of little value in both fumigated and untreated soil. Average yields of Lee soybeans on untreated soil infested with the nematode in 1958 through 1962 were highest in plantings made May 1 through May 15, a date presently recommended for planting. Yields on fumigated soil for 1961 and 1962 were also highest in plantings made May 1 through May 15. Row fumigation of infested soil with ethylene dibromide (EDB) in 1961 and 1962 tended to level out yields in plantings made April 15 through July 15. Greatest increase in yields from fumigation for the 2-year period was obtained in late plantings, June 1 through July 15. A smaller increase in yield was secured following fumigation in plantings made May 1 through May 15 than at any other date.

626. EPPS, J. M., and A. Y. CHAMBERS. 1963. Which seeding dates for soybeans on cyst nematode infested soil? Tennessee Farm and Home Sci. Prog. Rpt. 48, pp. 6–8.

Manipulation of the seeding date of soybeans to reduce yield losses caused by the soybean-cyst nematode was found of little value on both fumigated and untreated soil. Average yields of Lee soybeans on untreated soil infested with the nematode were highest in 1958 through 1962 in plantings made May 1 through 15, dates now recommended for planting soybeans. Yields on fumigated soil for 1961 and 1962 were also highest in plantings made May 1 through 15. Row fumigation of infested soil with ethylene dibromide in 1961 and 1962 tended to level out yields from plantings made April 15 through July 15. Greatest increases in yields from fumigation for the 2-year period were obtained from later plantings, June 1 through July 15.

A smaller increase in yield was secured from fumigation in plantings made May 1 through 15 than at any other date. Good yields were harvested from plantings made April 15 through 30 on both fumigated and untreated soil, but planting before May 1 is not recommended because of possible reduction in plant growth, yield, and seed quality due to early flowering and an increased weed problem with the longer growing period. Fumigation is not now considered practical for soybean production because the increased production obtained does not pay for the high cost of materials and application.

627. EPPS, J. M., and A. Y. CHAMBERS. 1964. Behavior of populations of *Heterodera glycines* under various cropping sequences in field bins. Phytopathology 54:622. (Abstr.)

An abstract of entry 632.

628. EPPS, J. M., and A. Y. CHAMBERS. 1964. Nematicidal seed treatment for control of *Heterodera glycines* in soybeans. Phytopathology 54:622. (Abstr.)

Technical DBCP (1,2-dibromo-3-chloropropane) was coated onto soybean seed (Lee cultivar) in sufficient amounts to supply ⅛, ¼, ⅓, and ½ gal./acre at seeding rates of 45 lb./acre. In four experiments during 1961 through 1963, the nematicide reduced stands of plants significantly at all rates in one experiment; reduced stands appreciably at the highest three rates in two experiments; and did not affect stands significantly in one

experiment. White female index readings made 1 month after planting showed significant reduction in nematode infection with all rates of DBCP, but yields of soybeans were not increased significantly in any of the experiments. Yields were significantly reduced by the ½ gal. rate in two experiments.

629. EPPS, J. M., J. N. SASSER, and G. UZZELL, JR. 1964. Lethal dosage concentrations of nematicides for the soybean cyst nematode and the effect of a nonhost crop in reducing the population. Phytopathology 54: 1265–1268.

In microplot tests a high degree of control of the soybean-cyst nematode was obtained with low concentrations of nematicides. Planting a nonhost crop after nematicide treatments further reduced nematode populations. However, nematodes were recovered in 1963 from soybean plots treated with fumigants in 1960 and planted to corn in 1960, 1961, and 1962. Nematodes were recovered from plots treated with methyl bromide at rates up to 9 lb./100 sq. ft. When soybeans were planted after fumigation, high populations of nematodes developed and, in most cases, populations were much higher at harvest in treated than in untreated plots. None of the fumigants and rates tested controlled the nematode 100%.

630. EPPS, J. M., and A. Y. CHAMBERS. 1965. Behavior of soybean cyst populations under different cropping systems. Tennessee Farm and Home Sci. Prog. Rpt. 53, pp. 4–6.

An abstract of entry 632.

631. EPPS, J. M., J. N. SASSER, and G. UZZELL, JR. 1965. Relative effectiveness of various nematicides in controlling the soybean cyst nematode and the added effect of a nonhost crop in reducing the population. Nematologica 11:36–37. (Abstr.)

Microplot test conducted at Rocky Point, N.C., and Ridgely, Tenn., over a 4-year period, 1960–1963, evaluated the effectiveness of several nematicides for control of the soybean-cyst nematode (*Heterodera glycines*). Various rates and methods of application were used. Fumigants evaluated in 1960 included brozone (¼, ½, and 1 lb./100 sq. ft.); D-D (60 and 80 gal./acre) single application with plastic cover; D-D (60 and 80 gal./acre) in split application (30 and 15, and 30 and 30, respectively) without cover. In 1961 the microplots were reworked, additional inoculum added, and fumigated with methyl bromide at 1, 1½, and 3 lb./100 sq. ft. D-D was applied at 100, 150, and 200 gal./acre in a single application without cover, and 80, 100, 120, and 140 gal./-acre in split applications (40 and 40, 50 and 50, 60 and 60, and 70 and 70, respectively). In 1962 the microplots were again reworked and additional inoculum added and treated with methyl bromide at ¼, ½, 1, 2, 3, 4, 5, 6, 7, 8, and 9 lb./100 sq. ft. Soybeans were planted each year following treatment. None of the fumigants used, regardless of dosage or method of application, eradicated the nematodes. Excellent control, however, was obtained with most fumigant treatments.

Split applications and use of covers for D-D and telone did not significantly increase their effectiveness. Another series of microplots treated in 1960 with the same treatments evaluated in 1960, were planted to corn, a nonhost crop, in 1960, 1961, and 1962. Nematode populations were low in most plots each year in the absence of soybeans, and in many plots viable larvae could not be detected by conventional sampling procedures after one or more years of nonhost crop. Soybeans, however, planted in these plots in 1963 were infected, indicating a residuum of inoculum. Results of these tests indicate that (1) the nematicides performed similarly at both locations; (2) nematode population was greatly reduced even with low levels of nematicides; (3) nematode population continued to decline in the absence of soybeans but after 3 years, from the few survivors the population increased rapidly on soybeans; and (4) complete eradication appears impracticable.

632. EPPS, J. M., and A. Y. CHAMBERS. 1965. Population dynamics of *Heterodera glycines* under various cropping sequences in field bins. Phytopathology 55: 100–103.

Build-up and decline in population of soybean-cyst nematode under seven different 5-year cropping sequences were studied during 1959–1963 in naturally infested, wood-framed field bins. Populations remained high throughout a sequence of continuous susceptible soybeans. In sequences of continuous cotton or continuous resistant soybeans, no nematodes could be found by sampling after the second crop year, but bulk quantities of soil collected from bins of the two sequences after 4 crop years contained enough nematodes for attacks on susceptible soybeans in a bioassay in the greenhouse. However, after 5 crop years, no nematodes were found in a bioassay. In two sequences in which susceptible soybeans were alternated with cotton and resistant soybeans, populations fluctuated from moderately high after the susceptible crop to very low after the nonsusceptible crops. When susceptible soybeans were planted after 2 years of cotton, nematode populations were extremely high after the first crop of susceptible soybeans, declined to numbers comparable to those of continuous susceptible soybeans after the second crop, and continued high in the succeeding crop. After 1 year of cotton, build-up of populations was gradual in two crops of susceptible soybeans following cotton. Populations declined again in 2 additional years of cotton following the two crops of susceptible soybeans.

633. EPPS, J. M., and A. Y. CHAMBERS. 1965. Nature of resistance in soybean varieties resistant to *Heterodera glycines*. Phytopathology 55:498. (Abstr.)

An abstract of entry 352.

634. EPPS, J. M. 1965. Reaction of sugarbeet varieties to the soybean cyst nematode. Plant Dis. Reptr. 49:747.

The soybean-cyst nematode did not reproduce on 15 sugar beet varieties.

635. EPPS, J. M., and A. M. GOLDEN. 1966. Significance of males in reproduction of the soybean cyst nematode (*Heterodera glycines*). Proc. Helminth. Soc. Washington 33:34.

Males were necessary for reproduction of the soybean-cyst nematode. No reproduction occurred on roots of plants inoculated with a single larvae. Females can develop to normal sizes in the absence of males but are incapable of producing viable eggs.

636. EPPS, J. M., and A. Y. CHAMBERS. 1966. Comparative rates of reproduction of *Heterodera glycines* on 12 host plants. Plant Dis. Reptr. 50:608–610.

Rates of reproduction of the soybean-cyst nematode, *Heterodera glycines,* were compared on cultivated plants and weeds in four greenhouse experiments. Hemp sesbania allowed two to four times more reproduction (white females and brown cysts) per gram of root than soybean. Kobe lespedeza allowed seven times more reproduction than that on soybean in one experiment and equivalent to that on soybean in three others. Korean lespedeza, henbit deadnettle, and wild soybean allowed reproduction equal to soybean. Reproduction on adzuki bean and mung bean was equal to that on soybean in three of four experiments. Snap bean and white lupine were about equal to soybean for reproduction in two experiments, but significantly poorer in two experiments. Sericea lespedeza and hairy vetch were poor hosts in all experiments.

637. EPPS, J. M., and A. M. GOLDEN. 1967. Biological differences in populations of the soybean cyst nematode, *Heterodera glycines.* Nematologica 13:141. (Abstr.)

Greenhouse studies on susceptible and resistant soybean cultivars and breeding lines indicate that there are two, possibly three, biological races of *Heterodera glycines* in the United States. One race that is found in the Holland, Va., and Elizabeth City, N.C., areas was pathogenic and reproduced moderately on two resistant soybeans (Pickett and D63-7320). A second type which is found in the Mississippi Valley and the Wilmington area of North Carolina, exhibited much less pathogenicity and reproduction on the two resistant soybeans. Populations from all sources were highly pathogenic and produced large numbers of white females on roots of susceptible cultivars (Lee and Hill). In addition, the population from the Wilmington area was the only one that caused yellowing of foliage of susceptible cultivars (Lee and Hill). This difference may be due to suppression of normal *Rhizobium* development on roots of nematode-infected plants. Other populations did not cause chlorosis of foliage, even with heavy infection. These studies suggest that there are biological races or strains of the soybean-cyst nematode, some of which are capable of moderate reproduction on the newly developed yellow-seeded Pickett and D63-7320 (an advanced resistant breeding line), and one population can be differentiated by foliage symptoms of heavily infected plants. These differences in population behavior are associated with morphological differences found previously in microscopic studies.

638. EPPS, J. M., and E. E. HARTWIG. 1967. Dyer, a new nematode resistant soybean variety. Univ. Tennessee Bull. 426.

A new soybean cultivar Dyer was released by the Tennessee and Missouri Agricultural Experiment Stations and U.S. Department of Agriculture. The cultivar has excellent resistance to soybean-cyst nematode and southern root-knot and cotton root-knot nematodes.

639. EPPS, J. M., and A. M. GOLDEN. 1967. Suitability of Kobe lespedeza for reproduction of isolates of the soybean cyst nematode from nine locations. Plant Dis. Reptr. 51:775–776.

Isolates of the soybean-cyst nematode (*Heterodera glycines*) reproduced on *Lespedeza striata,* variety Kobe, in greenhouse experiments. Some variations occurred in rates of reproduction, but all isolates were highly pathogenic and could not be differentiated on this host. Kobe lespedeza may be an important host under field conditions.

640. EPPS, J. M., and A. Y. CHAMBERS. 1967. Control of the soybean cyst nematode. Soybean Dig. 27(9): 6–9.

A popular article, discussing distribution, symptoms and signs, host range, spread, and control of the soybean-cyst nematode. Results of soil fumigation, crop rotation, and time of planting experiments are discussed and resistant cultivars are described. Cultivars Pickett and Dyer are resistant.

641. EPPS, J. M. 1968. Survival of soybean cyst nematodes in seed bags. Plant Dis. Reptr. 52:45.

Survival of larvae in cysts stored 17, 18, and 22 months or longer in seed bags indicate that cyst-infested seed stocks may serve as a source of dispersion for the soybean-cyst nematode.

642. EPPS, J. M. 1969. Nine varieties of southern peas resistant to the soybean cyst nematode. Plant Dis. Reptr. 53:245.

Ten cultivars (Pinkeye, Purple Hull, Texas Cream, Knuckle Hull crowder, Mississippi Silver, Arkansas 208, Mekan, Virginia 61-5, Virginia 59-41, and Louisiana 63-3) of *Vigna sinensis* may be used as rotation crops in soybean cultivation since they were found to be resistant

to Tennessee and Virginia strains of *Heterodera glycines.*

643. EPPS, J. M. 1969. Survival of the soybean cyst nematode in the digestive systems of birds. J. Nematol. 1(4):286. (Abstr.)

An abstract of entries 648 and 649.

644. EPPS, J. M. 1969. Survival of the soybean cyst nematode in seed stocks. Plant Dis. Reptr. 53:403–405.

Small balls of soil, or "peds," recovered from three seed sources contained cysts of the soybean-cyst nematode (*Heterodera glycines*). Examination of three lots of natural peds showed that 1, 6, and 9% of the peds contained cysts. Most of the infested peds contained only one cyst; however, as many as four were recovered from some peds. Five and eight months after the peds were harvested with the seed, active larvae were observed, and nematodes from all the lots had infected soybean roots.

645. EPPS, J. M. 1970. Breeding soybeans for resistance to the soybean cyst nematode, *Heterodera glycines* and the root-knot nematode, *Meloidogyne* spp. 10th Internatl. Nematol. Symp., Eur. Soc. Nematol., Pescara, pp. 109–110.

Breeding soybeans for resistance to *Heterodera glycines* shows Peking cultivar as a major source of resistance in development of resistant cultivars Pickett, Dyer, and Custer. Cultivars Jackson, Hill, Delmar, Palmetto, S-100, Laredo and others were found to be resistant to root-knot nematodes. Cultivars showing resistance to more than one species of nematodes are Dyer, resistant to two species of root-knot nematodes, and both Dyer and Pickett, resistant to soybean-cyst nematode and reniform nematode, *Rotylenchulus reniformis.*

646. EPPS, J. M., and L. A. DUCLOS. 1970. Races of the soybean cyst nematode in Missouri and Tennessee. Plant Dis. Reptr. 54:319–320.

Populations of *Heterodera glycines* from Arkansas, Missouri, and Tennessee were found to develop on resistant cultivars Pickett, Dyer, Custer, Peking, and P. I. 90763. No morphological differences could be detected and differentiation of races must be made on their ability to develop on resistant varieties.

647. EPPS, J. M. 1970. Field and greenhouse evaluations of nematicides for soybean cyst nematode control. Phytopathology 60:417–419. (Abstr.)

Systemic and contact nematicides reduced the number of soybean-cyst nematodes, *Heterodera glycines,* when applied to infested soil in greenhouse tests. Some treatments resulted in increased top weight and a decrease in white female development on the roots. In field tests, application at time of planting resulted in increased vigor of the plants when compared to nontreated plots. Some treatments were slightly phytotoxic to the young plants, and some reduction in stand was noted. There was a significant increase in yield in some cases, but in no case did a treatment significantly increase the yield over that of the resistant Pickett or Dyer cultivars that were not treated. These limited tests indicate that some of the new systemic and contact nematicides may have a place in the control of nematodes in the low-per-acre-income crops.

648. EPPS, J. M. 1971. Recovery of soybean cyst nematodes (*Heterodera glycines*) from the digestive tracts of blackbirds. J. Nematol. 3:417–419.

Digestive tract contents and feces of blackbirds were examined for cysts of *Heterodera glycines,* the soybean-cyst nematode. Birds fed under laboratory conditions and trapped in naturally infested fields were checked. Infective larvae were recovered from cysts in the excrement of birds 24 and 48 hr. after they were fed cysts. Birds that were force-fed eggs and larvae discharged infective larvae in the excrement. Birds that consumed cysts mixed with feed, and cysts in feed mixed with soil, discharged numerous cysts containing infective larvae. Seven of 54 starlings, trapped and killed in an infested field, contained cysts in their digestive tracts.

649. EPPS, J. M. 1972. Recovery of soybean cyst nematodes from the digestive tract of blackbirds. Tennessee Farm and Home Sci. Prog. Rpt. 81, pp. 2–3.

Soybean-cyst nematode can pass through the digestive tract of blackbirds (*Molothrus ater* and *Quiscalus quiscula sturnis vulgaris*). The excreted cysts contain live larvae which develop freely on soybean roots.

650. EPPS, J. M., and E. E. HARTWIG. 1972. Reaction of soybean varieties and strains to race 4 of the soybean cyst nematode. J. Nematol. 4:222. (Abstr.)

Race 4 of *Heterodera glycines* attacks all commercial cultivars of soybeans recommended in Tennessee, Arkansas, and Missouri. In greenhouse tests, over 3,000 soybean cultivars and strains were planted in 8 cm clay pots containing soil infested with *H. glycines.* Individual plants were grown 30 days, removed, the roots examined for presence of white females, and root systems rated for resistance. Ratings were based on number of white females (0 = none; 1 = 1–5; 2 = 6–10; 3 = 11–30; 4 = > 30). Most cultivars and strains were susceptible, with ratings of 3 and 4, but a few had varying degrees of resistance with ratings of 0–2. A few plant introductions (P.I.) and cultivars from the germplasm collections had low ratings. White females were found infrequently on P.I. 88,788, P.I. 89,772, P.I. 87,631-1, Cloud, Columbia, Peking, P.I. 84,751, and P.I. 90,763. Some of these apparently have a mixture of plant types in terms of reaction to race 4.

Progeny of resistant plants were more uniformly resistant than were the parents. P.I. 88,788, P.I. 89,772, and P.I. 87,631-1 have been selected for use in breeding programs

to develop resistance to race 4. P.I. 88,788 is a superior line because it has low lodging and shattering characteristics, and also has a high degree of resistance to *Meloidogyne incognita acrita*. Strains having the highest level of resistance to race 4 previously had been screened for resistance to one or more of the three other races of *H. glycines*. Degree of resistance of the new strains of soybeans to race 4 was lower than resistance observed with Peking cultivar to race 3. However, the degree of resistance is adequate to withstand severe attack by race 4 under field conditions. Since races 3 and 4 occur together in many fields, new cultivars must have resistance to both races if they are to meet the needs of growers who plant soybeans in areas infested with these nematodes.

651. EPPS, J. M., D. I. EDWARDS, J. M. GOOD, and R. V. REBOIS. 1973. Annotated bibliography of nematodes of soybeans, 1882–1968. U.S. Dept. Agr. ARS, ARS-S-8. 75 pp.

A listing of 380 references on nematodes of soybean is given.

652. EPPS, J. M., and E. E. HARTWIG. 1973. Forrest, a new nematode-resistant soybean variety. Univ. Tennessee Bull. 513. 11 pp.

A new soybean cultivar, Forrest, was released by the Mississippi and Tennessee agricultural experiment stations and Agricultural Research Service, U.S. Department of Agriculture. The cultivar has resistance to *Heterodera glycines* (race 3), *Meloidogyne incognita acrita,* and *Rotylenchulus reniformis.*

653. EPPS, J. M. 1974. Soybean nematodes. Workshop on soybeans for tropical and subtropical conditions, Univ. Puerto Rico, Feb. 4–6, 1974.

Plant-parasitic nematodes are a major factor where soybeans are grown. They cause reductions in yields estimated at 10% of the crop. There are more than 20 kinds that are capable of reducing yields. They damage the root systems of soybeans, causing poor growth and sometimes death of the plants. There are many ways they can be spread to new locations. Three methods have been used successfully to control nematodes — namely, rotations, chemicals, and resistant cultivars. These methods are not permanent and their usefulness is limited to the kind of nematode and availability of crops to use in rotation, proper use of chemicals, and cultivars with resistance suitable for production where infestations occur. It appears possible to grow soybeans in all areas where they are adapted regardless of the kind of nematode that is present if special efforts are made to utilize available research. There is a need for further research, especially on breeding, for resistance to nematodes of this crop.

653a. EPPS, J. M. 1974. Control of nematodes on soybeans. Proc. Amer. Phytopath. Soc. 1:159. (Abstr.)

A 3-year study was made to determine the effectiveness of soil-applied nematicides on control of nematodes of soybeans. In plots infested with race 3 of the soybean-cyst nematode (*Heterodera glycines*), increases in yield resulted from some nematicide treatments. None of the nematicides significantly increased yields when compared to that of a race 3 resistant cultivar. In plots infested with race 4 some nematicides significantly increased yields. It is apparent that resistant cultivars are as effective as nematicides for control of race 3. As no commercial cultivars are available that have a high level of resistance to race 4, nematicides can be used to increase yields where this race occurs.

654. ERDMAN, L. W., H. W. JOHNSON, and F. CLARK. 1956. A bacterial induced chlorosis in the Lee soybean. Plant Dis. Reptr. 40:646.

Upper leaf chlorosis is reported on Lee soybeans during the prebloom stage. The numbers of chlorotic plants varied from negligible to 10% at any one time. Many of the plants recovered spontaneously. The condition was found to be associated with certain rhizobial inoculants, as with other inoculants the symptoms never appeared.

655. ERWIN, D. C., and W. H. MC CORMICK. 1971. Germination of oospores produced by *Phytophthora megasperma* var. *sojae*. Mycologia 63:972–977.

Thick-walled oospores of the homothallic *Phytophthora megasperma* var. *sojae* contained a large, refractile body and two smaller pellucid bodies which, prior to germination, appeared to be absorbed. When oospores in V-8 juice agar were subjected to a 2-hr. day of fluorescent light, frozen for 24 hr. to kill mycelium, and incubated in water, about 40–70% germinated. The inner surface of the thick oospore wall appeared to erode from the inside just prior to germination. Incubation of cultures at 24 and 27 C was much more favorable to germinability of oospores than 15, 18, or 30 C. Although mycelial growth was excellent at 30 C, most oospores were malformed. No variation in morphology, cultural growth, or pathogenicity among 23 single oospore cultures was detected.

656. ERWIN, J. A. G. 1973. Charcoal rot of soybeans in Queensland. Australian Plant Path. Soc. Newsltr. 2:19.

Presence of *Macrophomina phaseolina* is confirmed in Australia. Abnormally hot weather experienced in Queensland in summer 1973 has probably contributed to the large losses caused by the fungus.

657. FAGBENLE, H. H., and R. E. FORD. 1970. Tobacco streak virus from soybeans, *Glycine max*. Phytopathology 60:814–820.

Tobacco streak virus (TSV) was isolated from naturally infected soybeans for the first time in Iowa and in the United States. This TSV isolate had a thermal inactivation point of 58 C, dilution end point of 1:640, longevity

in vitro of 24 hr., and a host range similar to a Brazilian strain of TSV isolated from soybean. It was inactivated more rapidly in tobacco sap than in cowpea or bean sap. At the end of 30 min., a 1:25 dilution of tobacco leaf sap infected with TSV was more infective than dilutions of 1:1 or 1:10. TSV infection in soybeans reduced seed and pod production and embryo vigor. Infective virus particles were 28 to 32 mμ in diameter. The Iowa TSV isolate reacted only with TSV antiserum. *Cassia occidentalis* is a new host for TSV.

658. FANG, C. T., H. Y. CHEN, and C. L. CHU. 1964. A comparatives study of the species of the genus *Xanthomonas* from leguminous plants [in Chinese, English summary]. Acta Phytopath. Sinica 7:21–31.

The authors suggest that *Xanthomonas sojense* should be described as *X. sojae,* as described by Burkholder.

659. FARR, M. L., and J. A. STEVENSON. 1964. A supplementary list of Bolivian fungi [in German]. Sydowia 17:37–69.

Xanthomonas phaseoli on leaves collected at Santa Cruz, 2 February 1953.

660. FARR, M. L. 1964. Mycological notes. III. New taxa combinations, host and locality records. Amer. Midl. Nature 71:363–368.

Dendrodochium fusisporum is a new record on soybean in the United States.

661. FASSULIOTIS, G., and G. J. RAU. 1967. The reniform nematode in South Carolina. Plant Dis. Reptr. 51:557.

A report of *Rotylenchulus reniformis* on soybean. This is the first report of this nematode in South Carolina, but the author suggests that it may may be present in other areas of the state. During 1965 heavy losses were sustained in soybean fields.

662. FASSULIOTIS, G., G. J. RAU, and F. H. SMITH. 1968. *Hoplolaimus columbus,* a nematode parasite associated with cotton and soybeans in South Carolina. Plant Dis. Reptr. 52:571–572.

The Columbia lance nematode was found associated with cotton and soybeans. Soybean plants were dwarfed and chlorotic and had few pods. As many as 4,220 nematodes were recovered per 100 cc of soil from the rhizosphere of soybean plants.

663. FASSULIOTIS, G. 1974. Host range of the Columbia lance nematode, *Hoplolaimus columbus.* Plant Dis. Reptr. 58:1000–1002.

Reproduction of *Hoplolaimus columbus* was tested on 16 plant species in the greenhouse. Bermuda grass, wheat, sweet corn, millet, soybean, lima bean, common bean, and watermelon were good to excellent hosts. Field surveys also showed that field corn and seven weed species were hosts.

664. FEASTER, C. V. 1952. Bacterial pustule disease in soybeans: artificial inoculation, varietal resistance, and inheritance of resistance. Missouri Agr. Expt. Sta. Res. Bull. 487. 26 pp.

Maximum infection occurs when plants are sprayed with inoculum when the stomata are open widest. Clemson was most resistant cultivar followed by Ogden. Resistance was indicated by slow development of lesions and absence of pustular outgrowth. Resistance is conditioned by a simple recessive evidence of linkage relations between factors for resistance and maturity.

665. FELDMESSER, J., D. I. EDWARDS, J.M. EPPS, C. M. HEALD, W. R. JENKINS, H. J. JENSEN, B. LEAR, C. W. MC BETH, E. L. NIGH, JR., and V. G. PERRY. 1971. Estimated crop losses from plant-parasitic nematodes in the United States. Spec. Pub. 1, Soc. of Nematol. 7 pp.

Using 1967–1968 average prices and 1962–1968 acreages, it was estimated that nematodes caused soybean losses in excess of 5 billion lb., with a farm value of nearly $52 million.

666. FENNE, S. B. 1940. Some observations on the development of root-knot nematode diseases in Virginia. Phytopathology 30:708. (Abstr.)

Sweet potatoes on some farms were heavily infested with root-knot nematode. An attempt to rotate the crop with supposedly resistant Laredo soybean resulted in heavy infection of soybeans by root-knot nematode. Some roots were an inch or thicker in diameter.

667. FENNE, S. B. 1942. More about soybean diseases from Virginia. Plant Dis. Reptr. 26:382.

Bacterial leaf and pod spot, Fusarium wilt, stem rot, root-knot, mosaic, and a nutritional deficiency were seen every year.

668. FENNE, S. B. 1942. Two new records for the frogeye leaf spot: Virginia. Plant Dis. Reptr. 26:383.

A new record of frog-eye leaf spot disease is reported for Virginia.

669. FENNE, S. B. 1949. Alfalfa and soybean diseases in Virginia, 1948. Plant Dis. Reptr. 33:90–91.

Reports the occurrence of pod and stem blight due to *Diaporthe sojae* (= *D. phaseolorum* var. *sojae*), frogeye leaf spot due to *Cercospora daizu* (= *C. sojina*), and sclerotial blight, *Sclerotium rolfsii.* Seed treatment of low-vitality seeds with arasan significantly increased stand.

670. FENNE, S. B., and W. C. WHITE. 1950. Chemical treatment of soybean seed increases germination in laboratory tests. Plant Dis. Reptr. 34:206–207.

Seed treatment with arasan increased the average germination 5.6% over nontreated seed.

671. FERRIS, V. R., and R. L. BERNARD. 1958. Plant parasitic nematodes associated with soybeans in Illinois. Plant Dis. Reptr. 42:798–801.

Plant-parasitic genera of nematodes found widely distributed in Ilinois soybean fields included *Pratylenchus, Paratylenchus, Helicotylenchus,* and *Tylenchorhynchus.* Comparisons of rotations indicated that higher counts of *Pratylenchus* and *Helicotylenchus* in soil were often associated with corn, whereas higher counts of *Pratylenchus* were associated with soybean culture.

672. FERRIS, V. R. 1961. A new species of *Pratylenchus* (Nemata-Tylenchida) from roots of soybeans. Proc. Helminth. Soc. Washington 28:109–111.

The author describes a new species, *Pratylenchus alleni,* found in roots of nine soybean cultivars from Eldorado, Ill.

673 FERRIS, V. R., and R. L. BERNARD. 1961. Seasonal variations of nematode populations in soybean field soil. Plant Dis. Reptr. 45:789–793.

Data on fluctuations in the numbers of plant-parasitic nematodes in soils of soybean fields were obtained over a -year period. Populations of nematodes of the genera *Paratylenchus, Helicotylenchus,* and *Tylenchorhynchus* built up during the growing season and reached a peak near the end of the period. Populations of nematodes of the genus *Pratylenchus* in the soil usually reached a peak early in the season and a decline followed. Population decline was greatest during very dry periods.

674. FERRIS, V. R., and R. L. BERNARD. 1962. Injury to soybeans caused by *Pratylenchus alleni.* Plant Dis. Reptr. 46:181–184.

Soybean plants grown in the greenhouse in the presence of *Pratylenchus alleni,* a species originally discovered in soybean breeding plots, had reduced root weight of 25%. In one experiment this reduction was obtained at a level of infection comparable with that of field-grown plants. Under certain environmental conditions, infection with this nematode probably causes reduced growth and yield of field-grown soybean plants.

675. FERRIS, V. R., and R. L. BERNARD. 1963. Effect of host crop on soil populations of several *Pratylenchus* species. Phytopathology 53:875. (Abstr.)

An abstract of entry 676.

676. FERRIS, V. R., and R. L. BERNARD. 1967. Population dynamics of nematodes in fields planted to soybeans and crops grown in rotation with soybeans. I. The genus *Pratylenchus* (Nemata:Tylenchida). J. Econ. Ent. 60:405–410.

The influence of crop species on the soil populations of four species of *Pratylenchus* (*P. hexincisus, P. scribneri, P. neglectus,* and *P. penetrans*) was studied for 5 years in 16 fields rotated to corn, soybeans, oats, wheat, and forage mixtures. Each field was sampled each year between mid-July and mid-August. Populations of *P. hexincisus, P. scribneri,* and *P. penetrans* increased in soil in which corn was growing. Populations of *P. penetrans, P. scribneri,* and *P. neglectus* increased in soils in which soybeans were growing. *P. hexincisus* and *P. neglectus* were capable of producing moderate populations on oats. *P. neglectus* was the only *Pratylenchus* species that built up on wheat. *P. scribneri* was found in moderate numbers in fields containing forage mixtures of alfalfa, red clover, and brome grass.

677. FERRIS, V. R., J. M. FERRIS, and R. L. BERNARD. 1967. Relative competitiveness of two species of *Pratylenchus* in soybeans. Nematologica 13:143. (Abstr.)

Four soybean seeds (Lincoln) were planted in each of 30, 15 cm pots of sterile soil mixture. After 2 days a suspension of surface-sterilized nematodes was pipetted to each pot. Subsequent additions of nematodes were made each day for 1 week until a total of 4,000 nematodes had been added to each pot. Ten of the pots received *Pratylenchus penetrans,* 10 received *P. alleni,* and, in the third group of 10 pots, each pot received an equal number of *P. penetrans* and *P. alleni.* Plants were allowed to grow for 3 months, at which time roots from each pot were incubated separately for 1 week in containers of aerated H_2O and aliquots of the emerging nematodes counted. Species and sex determination of 25–50 adult *Pratylenchus* specimens were made from each pot containing both species. A mean of 2,857 *Pratylenchus* was recovered from roots of pots that contained both species, with a significantly higher number ($P < 1\%$) of *P. penetrans* ($\bar{x} = 2{,}122$) than of *P. alleni* ($\bar{x} = 735$). From the roots of pots that contained a single species, the total number of *P. alleni* recovered ($\bar{x} = 1{,}752$) was significantly lower ($P < 1\%$) than the total number of *P. penetrans* recovered ($\bar{x} = 4{,}175$), but there was a large pot-to-pot variability within the test.

A second experiment was carried out exactly like the first except that numbers of nematodes were changed as follows: 10,000 *P. penetrans* were added to each of 10 pots; 15,000 *P. alleni* were added to each of 10 pots; and 5,000 *P. penetrans* plus 7,500 *P. alleni* were added to each of 10 pots. After 3 months the *Pratylenchus* recovered from the root systems were counted, and 50 to 100 specimens from each pot receiving both species were mounted on microslides for species and sex determination. A mean of 40,275 *Pratylenchus* was recovered from pots to which both species were added, with a significantly larger ($P < 1\%$) number of *P. penetrans* ($\bar{x} = 26{,}984$) than *P. alleni* ($\bar{x} = 13{,}291$), though in this experiment the heterogeneity factor between pots was also significant. The total number of *P. penetrans* ($\bar{x} = 31{,}000$) recovered from pots to which this species alone

was added was significantly less ($P < 1\%$) than the total number of *P. alleni* ($\bar{x} = 43{,}820$) recovered from pots in which it was the sole species added, but again there were large pot-to-pot variations.

In all groups of pots of both experiments the females of *P. penetrans* significantly ($P < 1\%$) outnumbered the males in ratios from 3:1–5:1. *P. alleni* in every instance but one had a ratio of females to males that either was equal or significantly ($P < 1\%$) favored the males. In pots of the second experiment containing both species, the female *P. alleni* outnumbered the males slightly ($P < 5\%$). The ratios of *P. alleni* females to males in the different pots in this group were plotted against the number of *P. alleni* recovered per g of root and the data were analyzed with a weighted regression analysis. The analysis showed that ratios favoring females were positively correlated ($r = .78$) with increased root population density. The higher proportion of females in *P. penetrans* may be a factor contributing to the greater number of that species recovered in both experiments from plants inoculated with both species.

678. FERRIS, V. R., J. M. FERRIS, R. L. BERNARD, and A. H. PROBST. 1971. Community structure of plant parasitic nematodes related to soil types in Illinois and Indiana soybean fields. J. Nematol. 3:399–408.

Using a resemblance equation and community ordination, community structure of plant-parasitic nematodes was studied and found to vary on dark- and light-colored soils of Illinois and Indiana. *Helicotylenchus pseudorobustus, Pratylenchus* spp., *Paratylenchus projectus, Tylenchorhynchus acutus, T. martini,* and *Xiphinema americanum* are considered.

679. FERRIS, V. R., and R. L. BERNARD. 1971. Effect of soil type on population densities of nematodes in soybean rotation fields. J. Nematol. 3:123–128.

Effect of soil type on population densities of plant-parasitic nematode species in 17 field blocks of four different soil types rotated to corn, soybeans, wheat, and forage mixtures was investigated during a generally droughty five-year period. High densities of *Helicotylenchus pseudorobustus* were found in dark silty-clay loams. Highest densities of *Tylenchorhynchus acutus* were also in one of the dark-colored silty-clay loams. Light-colored silt loams favored development of *Paratylenchus projectus,* which developed poorly in the darker soils. Comparable densities of *Xiphinema americanum* were found in all soils and on all crops, regardless of soil type. *Tylenchorhynchus martini,* although present, did not build up in any of the soils. Populations of *Pratylenchus* species were generally low in the rotated blocks of all soil types.

680. FIELDING, M. J., and J. P. HOLLIS. 1956. Occurrence of plant-parasitic nematodes in Louisiana soils. Plant Dis. Reptr. 40:403–405.

Tylenchorhynchus spp., *Pratylenchus* spp., *P. leiocephalus, Xiphinema americanum, Helicotylenchus* sp., *Hoplolaimus* spp., *H. coronatus,* and *Meloidogyne* spp. were found to be associated with soybeans.

681. FILIPJEV, I. N., and J. H. SCHUURMANS STEKHOVEN. 1941. A manual of agricultural helminthology. E. J. Brill, Leiden, Holland (The Netherlands). 878 pp.

Soybean was listed as a host of *Heterodera marioni* and *H. goettingiana.* Both reproduced freely. *Ditylenchus dipsaci* attacked soybean.

682. FORGHANI, B., H. L. SNAGER, and F. CROSSMAN. 1966. Viruses on oil pumpkin [English summary]. Nachr. Bl. dt. Pfl. Schutzdienst. Stutt. 18:113–116.

Tomato black-ring virus was found on soybeans in Germany.

683. FOX, J. A. 1967. Reproductive isolation in the genus *Heterodera.* Nematologica 13:143–144. (Abstr.)

The biological species concept is based on reproductive isolation. In an attempt to characterize the types and degree of reproductive isolation in the genus *Heterodera,* interspecific crosses were attempted between a representative of the round cyst group (the undescribed Osborne's cyst nematode), a representative of the lemon-shaped bullata group (*H. glycines*), and a representative of the lemon-shaped abullata group (*H. carotae*). Virgin females were used to attempt the following crosses: Osborne's cyst nematode females × *H. glycines* males; *H. glycines* females × Osborne's cyst nematode males; Osborne's cyst nematode females × *H. carotae* males; and *H. glycines* females × *H. carotae* males. No fertile cross resulted from any of these matings and no sperm was found in any of the females in an interspecific cross. Intraspecific matings of Osborne's cyst nematode and of *H. glycines* under the same conditions resulted in viable progeny. The most obvious mechanism isolating the species was failure of the female to attract males of a different species.

684. FOX, J. A., and M. G. KEREKES. 1969. Hatching response of some *Heterodera* species to sodium hypochlorite. J. Nematol. 1:8. (Abstr.)

Hypochlorite solutions have been reported to stimulate hatching of eggs of some *Heterodera* species. Because the Osborne cyst nematode (OCN), an undescribed species, was observed to be very responsive to NaOCl, studies were conducted to compare the effects of NaOCl on eggs of OCN, *H. schachtii, H. glycines, H. weissi,* and *H. carotae.* Eggs of each species were treated for 10 min. with an approximate 0.5% NaOCl solution, rinsed with distilled water and fixed in 4% formaldehyde. Two sources of NaOCl (Fisher Scientific Co. Lot No. 780565, 4 to 6%, and Easy Monday Bleach, 5.25%) were tested. Each species responded differently to the two solutions. OCN was the most responsive with 83% and 97% hatch

due to the Fisher and Easy Monday solutions, respectively. A 71% hatch due to the Fisher solution and 21% hatch due to the Easy Monday solution was recorded for *H. weissi,* while a 6% hatch due to Fisher solution and 68% hatch due to the Easy Monday solution was recorded for *H. schachtii. H. glycines* and *H. carotae,* with hatches ranging between 50% and 80%, did not show strong differential responses to the two solutions. In subsequent tests with OCN, *H. weissi* and *H. schachtii,* all three species had a hatch greater than 95% due to a 1.0% NaOCl solution (Fisher). The hatching phenomenon due to NaOCl appears to be passive, involving dissolution of the egg membranes and pressure exerted by the larvae as they tend to assume a straightened posture.

685. FOX, J. A., L. H. AUNG, and A. J. WEBBER. 1972. The relationship of a steroid to resistance of soybean to *Heterodera glycines.* J. Nematol. 4:224.

Resistance to the nematodes was of two kinds: (1) The resistance reduced the number of nematodes but was more effective against females than males. (2) Resistance did not reduce the number of nematodes but induced most larvae to become males. In Pickett (resistant cultivar) an estronelike substance was found, suggesting involvement of this compound in imparting resistance. It is possible that this host steroid could be precursor of nematode sex hormones. It is hypothesized that host steroids may influence nematode metabolism of growth and molting hormones to produce resistance.

686. FRANDSEN, N. O. 1952. [Studies on breeding for virus resistance in *Phaseolus vulgaris* L. I. Phytopathological studies.] Ztschr. f. Pflanzenzucht. 31:381–426.

Soybean, upon inoculation with bean yellow mosaic virus, produced veinclearing.

687. FRANDSEN, N. O. 1953. *Ascochyta sojaecola* on soybean in Germany [in German, English summary]. Phytopath. Z. 20:375–382.

First report from Europe for this disease on soybean, found in Lower Saxony and Baden in 1951 and 1952. Seedlings and foliage, stems, and pods of mature plants were attacked. The paper includes photographs of symptoms on cotyledons, leaves, stems, and pods. Pycnidia, conidia, and cultures are shown. Inoculation experiments with monospore culture gave positive results on soybean *Glycine ussuriensis* and beans.

688. FRANK, A. B. 1882. Gallen der *Anguillula radicicola* Greff an *Soja hispida, Medicago sativa, Lactuca sativa,* und *Pirus communnis.* Verb. Bot. Prov. Brandenburg 23(2):54–55.

A short description is given of the root gall on soybean in the greenhouse in Berlin.

689. FRANK, J. A., and J. D. PAXTON. 1970. The time sequence for phytoalexin production in Harosoy and Harosoy 63 soybeans. Phytopathology 60:6 (Abstr.)

An abstract of entry 690.

690. FRANK, J. A., and J. D. PAXTON. 1970. Time sequence for phytoalexin production in Harosoy and Harosoy 63 soybeans. Phytopathology 60:315–318.

Examination of soybean hypocotyls inoculated with *Phytophthora megasperma* var. *sojae* indicated that both Harosoy (susceptible) and Harosoy 63 (resistant) soybean plants produced a phytoalexin in response to infection. Within 4 hr. after inoculation, phytoalexin production and fungal development is similar in both cultivars. Differences in host-parasite interactions of the two cultivars become apparent between 4 and 8 hr. after inoculation. Phytoalexin is no longer detectable in Harosoy after 8 hr. and the disease develops, resulting in collapse of the hypocotyls within 48 hr. after inoculation. Phytoalexin production continues in the resistant cultivar, and after 24 hr. the plant cells surrounding the fungus become discolored and fungal invasion is halted. After 72 hr. the pathogen is killed, phytoalexin production ceases, and the existing phytoalexin begins to disappear. Therefore, since plant reactions to the pathogen are identical in the first 4 hr. of invasion, the reactions responsible for resistance or susceptibility appear to occur between 4 and 8 hr. when phytoalexin production either increases or declines.

691. FRANK, J. A., and J. D. PAXTON. 1971. An inducer of soybean phytoalexin and its role in the resistance of soybean to Phytophthora rot. Phytopathology 61:954–958.

A material capable of inducing phytoalexin production in soybean plants was isolated from *Phytophthora megasperma* var. *sojae.* This inducer is soluble in methanol and has a paper chromatographic Rf of 0.23 using a butanol:acid:water solvent (4:1:5, v/v). The molecular weight of the inducer is in the range of 10–30,000, and chemical tests indicate that is a glycoprotein. Production of this inducer is the key reaction attributed to the Rps gene for resistance in soybeans. The amount of inducer produced by the fungus was greatly increased when the fungus was in contact with the resistant (Harosoy 63) host tissue for 8 hr. This same increase in the amount of inducer could be stimulated by placing the fungus in the filter-sterilized juice of the resistant host for 8 hr. When the same procedure was carried out using the susceptible (Harosoy) host as the stimulator, there was no increase in the amount of inducer present in the fungus. Other soybean cultivars carrying the Rps gene reacted in a manner similar to the resistant Harosoy 63.

692. FRANKLIN, M. T. 1951. The cyst-forming species of *Heterodera.* Commonw. Agr. Bur. Farnham Royal, Bucks, England. 147 pp.

This is a book on species of cyst-forming nematodes,

their occurrence, morphology, hosts, type of damage, and economic importance.

693. FRANKLIN, M. T., and D. J. HOPPER. 1959. Plants recorded as resistant to root-knot nematodes (*Meloidogyne* spp.). Commonw. Agr. Bur. Farnham Royal, Bucks, England. 33 pp.

Plants are listed from the studies.

694. FREIRE, J. J. 1953. Bacterial pustule of soybean [in Portuguese]. Rev. Agron. 16:88–91.

Probably the first report of bacterial pustule from Brazil. Symptoms, isolation of the pathogen, inoculation, and control are discussed.

695. FRENCH, E. R. 1963. Effect of soil temperature and moisture on the development of Fusarium root rot of soybean. Phytopathology 58:875. (Abstr.)

Root rot of soybeans resulting where plants were grown in soil infested with *Fusarium oxysporum* was slight at low soil temperature (less favorable for soybean growth) and absent at high temperatures. In infested soil near moisture saturation, roots were healthy at 32, 29, and 26 C. At 23, 20, 17, and 14 C, root rot symptoms developed and were more pronounced with each additional drop in soil temperature. Two *F. oxysporum* isolates used in these tests were grown on potato-sucrose agar at 16, 19, 22, and 27 C, and the radial increment of growth was measured after 6 days. Increase of growth was correlated with increase in temperature. Implications are, therefore, that enhancement of the disease by lower temperatures probably results from lowered resistance of the host.

696. FRENCH, E. R., and B. W. KENNEDY. 1963. The role of *Fusarium* in root rot complex of soybean in Minnesota. Plant Dis. Reptr. 47:672–676.

The pathogenicity of *Fusarium* and *Rhizoctonia* isolated from soybean roots and hypocotyls was determined in greenhouse potted plants by an inoculum layer technique. *Fusarium oxysporum* Snyd. & Hans. was the predominant pathogen and an in vitro method of screening *Fusarium* isolates for pathogenicity was comparable to the inoculum layer technique. Histopathological observations revealed that *F. oxysporum* penetrates directly through epidermal cells and through stomata of the hypocotyl, eventually resulting in both inter- and intracellular invasion of the cortex. The stele is rarely affected.

697. FROMME, F. D. 1921. Diseases of cereal and forage crops in the United States in 1920. Plant Dis. Reptr. Suppl. 15:173.

Records the occurrence of bacterial blight caused by *Bacterium glycineum* (= *P. glycinea*) and mosaic caused by unknown factor.

698. FROSHEISER, F. I., and M. F. KERNKAMP. 1954. Asexual spore production in *Diaporthe phaseolorum* var. *batatatis*. Phytopathology 44:489. (Abstr.)

Recent workers have indicated that ascospores are the source of inoculum for the spread of stem canker on soybeans, caused by *Diaporthe phaseolorum* var. *batatatis* (= *D. ph.* var. *caulivora*). No pycnidial formation was observed by the writers in a year's study of the organism in numerous cultures on potato-dextrose agar or on naturally or artificially infested soybean stems in moist chambers, although perithecia were formed abundantly. Recently perithecia formed in abundance on autoclaved stems of 15 crop plants and weeds inoculated with ascospores. Pycnidia with conidia were observed on all the material except soybean, corn, and three species of weeds. Monoconidial isolates from autoclaved white sweet clover and wheat stems produced the usual numbers of perithecia on potato-dextrose agar. When mycelium from these cultures was transferred to water agar containing finely ground sweet clover stems and leaves, pycnidia were again produced in abundance. Blackhawk soybeans were inoculated in the greenhouse with conidia from cultures that were isolated from sweet clover; the organism was reisolated from those plants. These results indicate that the asexual spore stage may be more important in the spread of this disease in the field than has been suspected.

699. FROSHEISER, F. I. 1955. Studies on the etiology and epidemiology of *Diaporthe phaseolorum* var. *caulivora,* the cause of stem canker of soybean. Diss. Abstr. 15:1286–1287.

Soybean stem canker (*Diaporthe phaseolorum* var. *caulivora*) has increased in prevalence throughout most of the soybean areas of Minnesota since 1951. In studies at the University of Minnesota in 1952, inoculations made by inserting mycelium-bearing toothpicks into the stems of healthy plants generally produced typical symptoms, but this method is not satisfactory for testing for resistance because cultivars apparently resistant to natural infection are readily attacked by this method. An agar medium containing ground sweet clover leaves (1.5% agar) was the best substratum for pycnidia and conidia. Monoconidial isolates produced typical perithecia on potato-dextrose agar and typical stem canker symptoms when mycelium was used for inoculum. There was a yield reduction of 10 bu./acre when Blackhawk soybeans were inoculated by the toothpick method at 70 days, 67% of the plants being infected. This cultivar is the most susceptible in Minnesota but no canker has been observed on Ottawa Mandarin, Capital, or Flambeau in commercial fields. However, in a test with the toothpick method Ottawa Mandarin was as susceptible as Blackhawk. Of 16 cultivars compared for susceptibility to natural infection in a St. Paul field, Renville, Blackhawk, and Capital had 7.7, 5, and 2.9% infected plants, respectively, while Pridesoy 11, Ottawa Mandarin, and Flambeau were symptomless.

Susceptibility increases with age and reaches a maximum after pod formation. Under natural conditions Blackhawk plants sown on May 12 and 21 were more susceptible than those sown on June 1 and 10. There was no evidence that systemic infection follows seedling infection or using infected seed. Crimson, red, Ladino, and sweet clover (*Melilotus* sp.), lucerne beans (*Phaseolus vulgaris*), and garden peas all developed symptoms following inoculation with the pathogen. So far it is known to survive only in overwintered, infected soybean plant parts and seed.

700. FROSHEISER, F. I. 1956. Storing inoculum of *Pseudomonas glycinea* in host tissue by freezing. Phytopathology 46:526.

Soybean leaves naturally infected with *Pseudomonas glycinea* were stored in plastic bags at −18 C. After 10, 20, and 31 months storage, these were removed from the freezer, placed under tap water for 30 min., and comminuted in a Waring blender for 3 min. After straining through cheesecloth, the suspension was diluted and used as inoculum to spray the plants. This method of storing inoculum retains the virulence for more than 2 years and may consist of more virulent biotypes than would pure culture maintained on agar media.

701. FROSHEISER, F. I. 1957. Studies of the etiology and epidemiology of *Diaporthe phaseolorum* var. *caulivora,* the cause of stem canker of soybeans. Phytopathology 47:87–94.

Plants of susceptible soybean cultivars were inoculated with ascospores and conidia of *Diaporthe phaseolorum* var. *caulivora.* No stem canker symptoms developed although the pathogen was reisolated from numerous stems of inoculated plants. Inoculations made by inserting toothpicks infested with mycelium of the fungus into the stem generally caused typical symptoms of the disease. Cultivars appearing resistant to natural infection were readily infected by this method of inoculation. Pycnidia with viable conidia were produced by the fungus on autoclaved stems of sweet clover, red clover, alfalfa, wheat, rye, oats, barley, lambsquarters, and rough pigweed, and also on agar containing finely ground sweet clover leaves in 1.5% agar — the best substrate for producing pycnidia and conidia. Stem canker caused a loss in yield of 10.1 bu./acre when Blackhawk soybean plants 70 days old were inoculated with mycelium; 67% of the plants were infected. Inoculation of 84-day-old plants caused no significant reduction in yield.

Sixteen cultivars of soybeans were compared for susceptibility to natural stem canker infection. Renville, Blackhawk, and Capital contained 7.7, 5.0, and 2.9% infected plants, respectively, whereas Pridesoy 11, Ottawa Mandarin, and Flambeau showed no symptoms. No symptoms of stem canker developed on soybeans planted in artificially infested soil in the greenhouse or field. Seedlings were infected in test tubes and some were killed. Some infected seedlings recovered and grew to maturity without symptoms after being transplanted into autoclaved soil in the greenhouse. There was no evidence that infection of older plants was due to seedling infection or to the planting of infected seed. Crimson clover, Ladino clover, red clover, sweet clover, alfalfa, snap beans, and garden peas were infected in the greenhouse following inoculation with mycelium of *D. phaseolorum* var. *caulivora.* The only known method of survival of the pathogens is in overwintered plant parts and seed. It is possible that the pathogen lives saprophytically in the soil or survives in plant material other than soybean.

702. FUCIKOVSKY, L. A., and W. G. BENEDICT. 1965. Chlorophyll, P^{32}, and starch distributions in soybean leaves infected with *Pseudomonas glycinea, Septoria glycines,* and *Cercospora sojina.* Proc. Canad. Phytopath. Soc. 32:12–13. (Abstr.)

An abstract of entries 703 and 704.

703. FUCIKOVSKY, L. A. 1966. Changes in pigment, phosphorus -32, and starch in unifoliate leaves of soybeans infected by *Cercospora sojina.* Phytopathology 56: 987.

Ten days after inoculation of leaves, circular to irregular brown lesions each surrounded by a dark green margin developed. Tissues surrounding the margin became chlorotic. Amount of chlorophyll *a* and *b* and carotenoids was higher in infected tissues whereas in tissues surrounding the lesions, the amounts were lower than in noninoculated tissues.

704. FUCIKOVSKY, L. A. 1972. Pigments of soybean leaves infected by *Septoria glycines* and *Pseudomonas glycinea.* Trans. Brit. Mycol. Soc. 59:506–508.

When soybean cultivar Harosoy leaves were strip-inoculated separately with each pathogen, consistent decreases occurred in the content of chlorophylls *a* and *b* in the infected strips but carotenoid content was little changed. No changes were seen in noninfected parts of infected leaves. When leaves were inoculated with both pathogens in double strips 6 mm wide and 10 mm apart, the inoculated areas turned yellow and then brown and total chlorophyll was lower than in the singly infected areas. Total carotenoid increased in both infected areas of double-inoculated leaves; the area infected with *Septoria glycines* contained the highest level. The results suggest some interaction between the two microorganisms or substances they produce, even though separated by a noninfected area, and subsequent stimulation of the host cells.

705. FUELLEMAN, R. F. 1944. Hail damage to soybeans: Report of 1943 results. Trans. Illinois State Acad. Sci. 37:25–82.

Field tests on artificial hail damage to Richland soybeans indicate that all rates of defoliation reduce yields

severely during the period of pod formation, but only heavy damage affects yield during early growth periods previous to blossoming.

706. FUJIKAWA, T. 1951. On "Shirakium disease" (stem rot) of soybean [in Japanese]. Japan. J. Plant Prot. 5(21):42–44.

707. FUJIOKA, Y. 1952. List of crop diseases in Japan. Gen. Hqtrs. Supreme Commander Allied Powers, Tokyo. Japan. Econ. and Sci. Soc. Nat. Resources Div., Prelim. Study No. 73. 212 pp.

Reports the occurrence of the following on soybean: *Ascochyta* sp., *Cercospora kikuchii, C. sojina, Corticium centrifugum,* pod and stem blight (*Diaporthe phaseolorum* var. *sojae*), *Glomerella glycines,* pod rot caused by *Fusarium bulbigenum* var. *tracheiphilum, Macrophoma mame* Hara, *Mycosphaerella sojae* Hori, a basal stem rot caused by *Ophionectria sojae,* downy mildew (*Peronospora manshurica*), rust (*Phakopsora pachyrhizi*), bacterial blight (*Pseudomonas glycinea* var. *japonicum*), *Sclerotinia sclerotiorum,* bacterial pustule (*Xanthomonas phaseoli* var. *sojense*), and soybean mosaic virus.

708. FUJISE, S., S. HISHIDA, M. SHIBATA, and M. MATSUEDA. 1961. Structure of fusaroskyrin, a pigment of *Fusarium* species: A pathogen of the soybean purple speck disease. Chem. and Indus. 43:1754–1755.

709. FUJITA, K., and O. MIURA. 1934. On the parasitism of *Heterodera schachtii* Schmidt, on beans [in Japanese]. Trans. Sapporo Nat. Hist. Soc. 13:359–364.

A study of the host range of this nematode revealed that it infects the soybean, adzuki, kidney, and multiflora beans, but did not attack other legumes tested.

710. FUKAZAWA, N., Y. KOBAYASHI, and M. NAKATA. 1962. On the parasitic nematodes and their distribution in Shizuoka Prefecture, Japan [in Japanese, English summary]. Shizuoka Pref. Agr. Expt. Sta. Bull. 7, pp. 89–105.

Heterodera glycines was found in a few locations.

711. FUKUI, J., and H. YARIMIZU. 1953. Control of the nematode *Heterodera marioni* (Cornu) Goodey on soybean. II. Residual effectiveness of DD (dichloropropane-dichloropropene) application [in Japanese]. J. Kanto-Tosan Agr. Expt. Sta. 4:23–26.

The residual effectiveness of DD and chloropicrin for control of nematodes on soybeans was tested during 1949–1951. DD gave good residual effectiveness for one year but was found only in the early stage of plant growth. The second year, chloropicrin was not as effective as DD. DD is too expensive for extensive farm use in Japan.

712. FUKUI, J., H. YARIMIZU, K. IIZIMA, T. TANAKA, and S. IZUMI. 1953. Control of the nematode *Heterodera marioni* (Cornu) Goodey on soybean. I. Effect of DD (dichloropropane-dichloropropene) as worm killer [in Japanese, English summary]. J. Kanto-Tosan Agr. Expt. Sta. 4:19–22.

The effects of DD and chloropicrin application on soybean nematodes in a field of alluvial soil on the Korean Experimental Farm in 1949 are summarized as follows: DD by injection was very effective. Chloropicrin gave some control, but was inferior to DD.

713. FUKUSHI, T. 1932. A contribution to our knowledge of virus diseases of plants in Japan. Sapporo Nat. Hist. Soc. Trans. 12:130–141.

Mosaic was observed by the author at Sapporo in 1929. Most of the article is on the history of virus studies in general.

714. FULTON, J. M., C. G. MORTIMORE, and A. A. HILDEBRAND. 1961. Note on the relation of soil bulk density to the incidence of *Phytophthora megasperma* var. *sojae* root and stalk rot of soybeans. Canad. J. Soil Sci. 41:247.

A severe outbreak of the disease was induced by shallow tillage of a field of clay loam soil. In pots in which soil was compacted, more plants were infected.

715. FULTON, R. W. 1948. Hosts of the tobacco streak virus. Phytopathology 38:421–428.

Tobacco streak virus can infect soybean by artificial inoculation.

716. GALVEZ, G. E. 1963. Host-range, purification, and electron microscopy of soybean mosaic virus. Phytopathology 53:388–393.

Two legumes were found as new hosts of soybean mosaic virus (*Cassia occidentalis* L. and *Sesbania exaltata*). *Phaseolus lathyroides* was confirmed as another host. Certain cultivars of beans, cowpeas, and the weed *P. speciosus* became infected without symptoms. The virus was recovered from inoculated leaves of some bean cultivars and from *Dolichos lablab*. The virus in juice was destroyed after 4 days at room temperature, after 2 weeks at 4 C, and after 4 months when frozen. The thermal death point was 62 C and dilution end point was 10^{-5}. The virus was inactivated below pH 4 and above pH 9. It was most stable at pH 6. It could be partially purified using a combination of rate and equilibrium zonal centrifugation. Aggregation and initial low concentration of the virus were the main obstacles in its purification. The infectious particles were long, flexuous rods 15–18 mμ wide, with a most frequent length of 650–725 mμ.

717. GANGOPADHYAY, S., T. D. WYLLIE, and V. D. LUEDDERS. 1971. Charcoal rot disease of soybean transmitted by seeds. Plant Dis. Reptr. 54:1088–1091.

Charcoal rot disease of soybean, incited by *Macrophomina phaseoli* (= *M. phaseolina*), is seedborne under natural conditions. Infected seed have indefinite black spots and blemishes on the seed coat. Up to 24% of seed harvested from infected plants harbor the fungus and the weight of infected seed is reduced as much as 5%. Emergence of infected seed is reduced as much as 59%. The fungus will survive on and in the seed coat and is capable of infecting the radicle. Isolation from seed infected with *M. phaseoli* indicates that *M. phaseoli* is the dominant fungal species in the seed.

718. GANGOPADHYAY, S., D. K. AGARWAL, A. K. SARBHOY, and S. R. WADHI. 1973. Charcoal rot disease of soybean in India. Indian Phytopath. 26:730–732.

The disease caused by *Macrophomina phaseolina* occurred on 32–77% of the seedlings. Pycnidia of the fungus were formed. Phloem and xylem tissues became brown. Sclerotia of the fungus were obtained from soil depth of 15 cm. Hill cultivar was least susceptible and Harosoy most susceptible to the infection.

719. GANTE, T. 1954. Verticilliosis of soybeans [in German]. Nachrichtenbl. des Deut. Pflanzenschutzd. (Braunschw.) 6:38.

At Ladenburg on the Neckar, Germany, soybean developed a tracheomycosis which spread extensively with the onset of a wet spell following a protracted drought in summer 1952. *Verticillium albo-atrum* was isolated from the bases of infected stems. Apparently this is the first report on soybeans for Germany. The fungus was also present in stunted lupines in another part of the same field.

720. GARBOWSKI, L., and H. JURASZKOWNA. 1933. Diseases of useful plants in the period of 1926/-1930. A summary of reports of the plant protection stations [in Polish]. Rocznik Ochrony Roslin Sect. A, 1:97–235.

A briefly annotated list that reports the occurrence of *Sclerotinia sclerotiorum,* 1929, *Ascochyta* sp., 1930, bacteriosis, 1930, and mosaic, 1930, on soybeans in Poland.

721. GARDNER, M. W., and J. B. KENDRICK. 1921. Soybean mosaic. J. Agr. Res. 22:111–114.

Affected plants were stunted, petiole and internodes shortened, leaflets stunted and greatly misshapen, puckered with dark green puffy areas along the veins. Between the puffy areas leaf tissues were etiolated. Affected leaflets were asymmetrical, twisted, curled downwards. Pods were stunted and flattened, less pubescent, acutely curved. Yield losses were high. Virus was seed transmitted.

722. GARDNER, M. W. 1924. Indiana plant diseases, 1921. Proc. Indiana Acad. Sci. 33:163–201.

Bacterial blight organism is seedborne. Mosaic was found to a limited extent, and attempts to infect soybean fields were unsuccessful. *Macrosporium* sp. was found associated with spotting of older leaves. Record of occurrence of "lavender staining" (= purple stain) of seed.

723. GARDNER, M. W. 1927. Indiana plant diseases, 1925. Proc. Indiana Acad. Sci. 36:231–247.

Purple seed stain of soybean was found to be due to *Cercospora* sp., probably *C. kikuchii.* Notes on occurrence of bacterial blight and mosaic in Indiana. Purple seed stain noted in 1924. The causal fungus was isolated and resembles *C. kikuchii.*

724. GARDNER, M. W. 1928. Indiana plant diseases, 1927. Proc. Indiana Acad. Sci. 38:143–157.

Records the occurrence of *Diaporthe sojae* (= *D. phaseolorum* var. *sojae*), *Septoria glycines,* and *Cercospora kikuchii.* The seed formed in *D. sojae*-infected plants were badly wrinkled, darkened, and moldy. Seed infection by *C. kikuchii* appears mostly through hilum.

725. GARDNER, M. W., and E. B. MAINS. 1930. Indiana plant diseases, 1928. Proc. Indiana Acad. Sci. 39:85–99.

Record of occurrence of leaf spot caused by *Septoria glycines,* bacterial spot caused by *Bacterium glycineum* (= *P. glycinea*), mosaic disease, and downy mildew on soybean in Indiana.

726. GARZA, A. 1965. The relation of calcium nutrition and bacterial populations in roots to development of leaf symptoms in soybeans. Diss. Abstr. 25:4900.

Leaf symptoms [? caused by *Pseudomonas* and *Xanthomonas* spp.] were more severe in plants of cultivar Ford grown at 320 ppm Ca than at 40 ppm. The reactions of cultivar Chief were similar under both conditions. Roots of Ford plants in nutrient solutions contained higher bacterial populations but the solutions in which Chief plants were grown contained the most bacteria. Populations were higher in solutions containing higher Ca levels. Substitution of $Ca(NO_3)_2$ for $CaCl_2$ resulted in severe leaf symptoms; no symptoms occurred in solutions containing 10 ppm Ca and Cl at 71 or 568 ppm. Large populations of bacteria were present in solutions with high Cl levels. Leaf symptoms in Ford were reduced by a lower P content, but were increased by growing one Ford plant in the presence of five Chief plants, although resistance of the latter was unchanged. Ford symptoms were retarded by addition of *Rhizobium japonicum* to the higher Ca solutions and by applications of 1% agrimycin.

727. GASKIN, T. A., and H. W. CRITTENDEN. 1956. Studies of the host range of *Meloidogyne hapla.* Plant Dis. Reptr. 40:265–270.

The report covers studies of the host range of *Meloidogyne hapla.* Cultivars of soybeans varied in susceptibility.

728. GAUMANN, E. 1923. Beitrage zu einer monographie der gattung *Peronospora* Corda. Beitr. Kryptogamenflora Schweiz. 5:1–360.

Contains a technical description of *Peronospora manshurica.*

729. GEESEMAN, G. E. 1950. Physiologic races of *Peronospora manshurica* on soybeans. Agron. J. 42:257–258.

Three races were differentiated on seven pure line cultivars of soybean. Richland was susceptible to races 1 and 2 and, when inoculated with race 3, developed resistant pinpoint lesions. Chief, Manchu 3, T-117, Mukden, and Dunfield were immune to races 1 and 3, and formed small, resistant lesions with race 2. Illini was susceptible to all races. The three races can be distinguished by using cultivar Richland and any one of cultivars Chief, Manchu 3, T-117, Mukden, and Dunfield.

730. GEESEMAN, G. E. 1950. Inheritance of resistance of soybeans to *Peronospora manshurica.* Agron. J. 42:608–613.

This investigation was conducted under greenhouse conditions to determine the mode of inheritance of factors for reaction of soybeans to three physiologic races of downy mildew, *Peronospora manshurica.* The F_2 and F_3 reactions of susceptible $\times$ resistant crosses to races 1 and 2 indicated that, in each cross studied, one pair of factors, giving a 3:1 ratio, governed resistance. Resistance was found to be partially dominant. The reaction of the F_2 and F_3 generations between two susceptible varieties suggested that two complementary factors, giving a 9:7 ratio, conditioned resistance. Resistance to race 3 was governed by a single-factor pair in the cross Dunfield $\times$ Illini. Two factors, Mi_2 and Mi_R, conditioned resistance in the cross Mukden $\times$ Richland. The Mi_2 factor was epistatic to Mi_R, thus giving an F_2 ratio of 12:3:1. Two complementary factors plus a third factor, Mi_R, were found to govern resistance in the cross Illini $\times$ Richland. The Mi_R factor was hypostatic to mi_1 and Mi_2, thus giving an F_2 ratio of 9:3:4. Results indicated that the three factors segregated independently. Comparison of the F_3 reaction to the three races indicated that the same major factors controlled resistance to all races. The phenotypic expression of the $Mi_1Mi_1Mi_2Mi_2$, $Mi_1Mi_1Mi_2mi_2$, $Mi_1mi_1Mi_2Mi_2$, and $Mi_1mi_1Mi_2mi_2$ genotypes to races 1 and 3 was highly resistant whereas the reaction to race 2 was slightly susceptible. A third factor Mi_R which affected the reaction to race 3 was present in certain cultivars. The genotypes of Illini, Richland, and the resistant cultivars Dunfield, Chief, and Mukden were assumed to be $mi_1mi_1Mi_2Mi_2Mi_RMi_R$, $Mi_1Mi_1mi_2mi_2Mi_RMi_R$, $Mi_1Mi_1Mi_2Mi_2mi_Rmi_R$, respectively.

731. GERDEMANN, J. W. 1953. An undescribed fungus causing root rot of red clover and other Leguminosae. Mycologia 45:548–554.

Leptodiscus terrestis is pathogenic to soybeans.

732. GERDEMANN, J. W., and M. B. LINDFORD. 1953. A cyst-forming nematode attacking clovers in Illinois. Phytopathology 43:603–608.

A cyst-forming nematode identified as *Heterodera schachtii* var. *trifolii* did not attack soybean and some other crops.

733. GERDEMANN, J. W. 1954. The association of *Diaporthe phaseolorum* var. *sojae* with root and basal stem rot of soybean. Plant Dis. Reptr. 38:742–743.

The pod and stem blight fungus, *Diaporthe phaseolorum* var. *sojae,* was found associated with root and basal stem rot of soybean in four Illinois fields. When soybeans were planted in soil infested with this organism, lesions developed on cotyledons, lower hypocotyls, and upper tap roots. Several seedlings were killed and others stunted. One week after emergence, lesions made no further development. In spring 1954 the pod and stem blight fungus was found in a viable condition on old soybean stems found buried in the soil of a field that had not been in soybeans since 1951. The possibility is suggested that infection may sometimes occur on the root or basal stem of soybeans, remain semidormant through the growing season, and spread through the plant as it matures.

734. GERDEMANN, J. W. 1962. A species of *Endogone* from corn causing vesicular arbuscular mycorrhiza. Mycologia 53:254–261.

Endogone sp. infected soybeans by means of chlamydospores.

735. GHANEKAR, A. M., and F. W. SCHWENK. 1974. Seed transmission and distribution of tobacco streak virus in six cultivars of soybeans. Phytopathology 64:112–114.

Six soybean cultivars at three stages of growth were inoculated with isolates of tobacco streak virus (TSV), one from soybean (A-TSV), one from tobacco (W-TSV). For either isolate, all plant parts except pollen, embryos of immature seeds, and noninoculated leaves that had developed prior to inoculation, consistently assayed positive for virus. Depending on the cultivar, 0–20% of the seedlings from immature seeds from A-TSV plants contained A-TSV; the percentage was higher in seedlings from mature seeds. Differences in seed transmission were noted among cultivars (2.6–30.6%). Of the cultivars tested, Wayne had the highest percentage of transmission. W-TSV was not transmitted through either mature or immature seeds.

736. GIBBONS, F. P., and E. L. NIXON. 1929. The

invasion of plant tissue by bacterial parasites. Ann. Rpt. Pennsylvania Agr. Expt. Sta. 42, pp. 14–15.

Bacterium leguminosarum enters the cells of soybean through cavities in the walls. It migrates in its early invasion as inter- and intracellular zoogloeae, while in later stages it becomes intracellular.

737. GIBSON, F. 1922. Sunburn and aphid injury of soybeans and cowpeas. Arizona Agr. Expt. Sta. Tech. Bull. 2.

A weakly parasitic *Alternaria* infected soybean leaves through aphids and sunburn injuries. The fungus is briefly described and named *A. atrans* n.sp. The first indication of sunburn injury is appearance of interveinal, very small brick-red spots on upper surface of leaves. Many spots may increase in diameter to 4 mm.

738. GILBERT, J. C., J. T. CHINN, and J. S. TANAKA. 1970. Four new tropical vegetable-type soybeans with root-knot nematode resistance. Res. Rpt. Hawaii Agr. Expt. Sta. No. 178. 7 pp.

Four new soybean varieties, Kailua, Kaikoo, Kahala, and Mokapu Summer, resistant to *Meloidogyne* spp., are described.

739. GILLASPIE, A. G., and J. B. BANCROFT. 1965. The rate of accumulation, specific infectivity, and electrophoretic characteristics of bean pod mottle virus in bean and soybean. Phytopathology 55:906–908.

Concentration, specific infectivity, and electrophoretic characteristics of bean pod mottle virus were related to infection age in soybean and bean. Virus concentration increased soon after inoculation and then declined at a rate dependent on kind of measurement used. Specific infectivity decreased with increasing infection time in a manner suggesting first-order kinetics. This decrease was associated with an increase in ratio of slow:fast electrophoretic components. The effect of pancreatic ribonuclease added to purified virus preparations from young and old infections appeared not to approximate the mechanism of in vitro inactivation.

740. GILMAN, J. C., and L. H. TIFFANY. 1950. Some species of *Colletotrichum* on leguminous forage crops. Phytopathology 40:10. (Abstr.)

Of the three cultures isolated from soybean, one is the conidial stage of *Glomerella glycines* (not *Colletotrichum glycines*), one is similar to *Colletotrichum glycines* and *C. truncatum,* and the third resembles *C. pisi.*

741. GIPSON, I., K. S. KIM, and R. D. RIGGS. 1969. Ultrastructure of early development of syncytium by *Heterodera glycines* in roots of soybeans. Phytopathology 59:1027–1028. (Abstr.)

An abstract of entry 742.

742. GIPSON, I., K. S. KIM, and R. D. RIGGS. 1971. An ultrastructural study of syncytium development in soybean roots infected with *Heterodera glycines*. Phytopathology 61:347–353.

Syncytium formation in Lee soybean roots infected with *Heterodera glycines* was studied using the electron microscope at 42 hr., 4, 7, and 15 days after inoculation. Cell wall perforations appeared to be responsible for syncytium formation. Abnormal perforations in cell walls were noticeable within 42 hr. after inoculation. Size of the perforation increased with time after inoculation. At 15 days, component cells were no longer distinguishable. Vacuoles decreased in size with increasing age of syncytium, indicating that an increase in cytoplasm replaced the central vacuole. Plastids were abundant in early stages of syncytium formation, and decreased in number at later stages. Endoplasmic reticulumlike material increased with age of the syncytium, and was arranged in a parallel manner in older syncytia.

743. GODFREY, G. H. 1928. Legumes as rotation and trap crops for nematode control in pineapple fields. Assoc. Pineapple Canners, Univ. Hawaii Expt. Sta. Bull. 10. 211 pp.

In tests to determine suitable rotation crops to control the root-knot nematode, soybean cultivar Laredo was resistant. In another test to determine suitable trap crops, soybean cultivars Ototan, Biloxi, and Tarheel were susceptible to the root knot. No soybean varieties tested were considered desirable as rotation trap crops because they did not grow vigorously and were severely affected by Japanese beetle.

744. GODFREY, G. H. 1929. A destructive root disease of pineapples and other plants due to *Tylenchus brachyurus* n.sp. Phytopathology 19:611–629.

Soybean was infected by the nematode in Hawaii and the soybeans had been used as an indicator crop to show the presence of the nematodes. Infection on soybeans shows up as brown lesions on roots and rootlets.

745. GOLDEN, A., and J. M. EPPS. 1965. Morphological variations in the soybean-cyst nematode. Nematologica 11:38. (Abstr.)

Data obtained in studies on the soybean-cyst nematode (*Heterodera glycines*) indicate that this species is not morphologically uniform in all areas of occurrence. Based principally on length of tails and length and shape of the hyaline tail terminus of larvae, three different types were noted. One form, found commonly in northeastern North Carolina and southeastern Virginia and occasionally in the Mississippi Valley, has a short tail (42 μ) and a short, blunt hyaline tail terminus (22 μ). The second form, occurring mainly in the Wilmington area of North Carolina, has a long tail (50 μ) and a long, tapering hyaline tail terminus (26 μ). The third type, occurring in Japan and apparently some areas of the Mississippi Valley, is intermediate between the other two

forms, having a tail length of 45 μ and a hyaline tail terminus of 23 μ.

746. GOLDEN, A. M., J. M. EPPS, R. D. RIGGS, L. A. DUCLOS, J. A. FOX, and R. L. BERNARD. 1970. Terminology and identity of intraspecific forms of the soybean cyst nematode *Heterodera glycines*. Plant Dis. Reptr. 54:544–546.

The term "race" was selected for designation of intraspecific forms of the soybean-cyst nematode. The criterion to be used in determining the race status of a particular population of this nematode is its ability to reproduce on a set of selected soybean differentials. Tail length of infective nematode larvae should be included as supplemental data for each race when first reported. Guidelines to be followed in making race determinations are suggested. Four races (numerically designated) of the soybean-cyst nematode known to occur in the United States are characterized.

747. GOOD, J. M. 1956. Plant-parasitic nematodes of Georgia. Georgia Agr. Expt. Sta. Serv. (n.s.) 26:1–14. (Mimeo.)

Nematodes commonly found in Georgia are root-knot species, meadow, sting, stubby-root, stylet, spiral, ring, dagger, and lance. The author discusses control by rotations and soil fumigants.

748. GOOD, J. M. 1968. Assessment of crop losses caused by nematodes in the United States. FAO Plant Prot. Bull. 16(3):37–40.

A comprehensive review of methods used to determine nematode losses to agricultural crops, including soybeans.

749. GOOD, J. M. 1973. Nematodes. *In* B. E. Caldwell (ed.), Soybeans: Improvement, production and uses, pp. 527–544. Amer. Soc. Agron., Madison, Wis.

A brief review of recent literature of soybean diseases caused by nematodes.

750. GOODCHILD, D. J. 1956. Relationships of legume viruses in Australia. I. Strains of bean yellow mosaic virus and pea mosaic virus. II. Serological relationships of bean yellow mosaic virus and pea mosaic virus. Australian J. Biol. Sci. 9:213–230, 231–237.

Soybeans were susceptible by inoculation to bean yellow mosaic virus (BYMV) but not to two Australian strains of pea mosaic virus (PMV). Cross-agglutination experiments showed the strains of PMV and BYMV to be serologically related and cross-protection tests support the hypothesis that these are strains of the same virus.

751. GOODEY, T. 1940. The nematode parasites of plants catalogued under their hosts. Imp. Bur. Agr. Parasit., St. Albans, England. 80 pp.

The paper lists soybean as a host of *Anguillulina dipsaci* (leaf gall), *A. pratensis, Heterodera schachtii,* and *H. marioni.*

752. GOODEY, T. 1956. The nematode parasites of plants catalogued under their hosts. (Rev. ed., J. B. Goodey and M. T. Franklin). Commonw. Agr. Bur., Farnham Royal, Bucks, England. 140 pp.

A listing of several common species of nematodes as parasites of soybeans.

753. GOODEY, T., M. T. FRANKLIN, and D. J. HOOPER. 1959. Supplement to the nematode parasites of plants catalogued under their hosts, 1955–58. Commonw. Agr. Bur., Farnham Royal, Bucks, England. 66 pp.

New records of nematode parasites of *Glycine hispida* and *G. soja* (soybean) from the literature include *Helicotylenchus nannus, Helicotylenchus* sp., *Meloidogyne inornata, M. javanica* v. *bauruensis, Paratylenchus projectus, P. penetrans, Pratylenchus* spp., *Rotylenchulus reniformis, Trichodorus christiei, Trichodorus* sp., and *Tylenchorhynchus* sp.; *T. martini* on Acadian and Pelican cultivars of *Glycine hispida; Heterodera trifolii* on Deerfield, Perry, Comet, Blackhawk, Earlyana, Hawkeye, and Richland cultivars; *Meloidogyne hapla* on Laredo, Mukden, Anderson, Monroe, and Blackhawk cultivars. *Glycine javanica* is parasitized by *Meloidogyne incognita* v. *acrita* and *M. javanica;* and *Glycine ussurensis* by *Heterodera glycines.*

754. GOODEY, T. 1963. Soil and freshwater nematodes. (2nd ed., rev., J. B. Goodey). Methuen, London, England. 544 pp.

A textbook on nematodes in general, including brief mention of nematodes of soybean.

755. GOOT, P. V. D., and H. R. A. MULLER. 1932. Pests and diseases of the soybean crop in Java. Preliminary report [English summary]. Landbouw Tijdschr. Vereen. Landb. Nederl.-Indie. 7:683–704.

Diseases are of minor importance in Dutch East Indies. Foot rot (*Sclerotium rolfsii*) may cause loss under wet conditions. Anthracnose under prevailing wet weather may cause leaf drop and seed rot. Seedlings from infected seeds may die. Slime disease caused by *Bacterium* (= *Pseudomonas*) *solanacearum* is also reported.

756. GORDEICHUK, A. I., and E. E. SOKOLOVA. 1972. Preparation of diagnostic antisera for soybean mosaic virus [English, German, French summaries]. Vest. sel. khoz Nauki, Mosk. 17:101–103.

Antisera with low titers 1:64 and 1:128 were obtained by virus precipitation at isoelectric point.

757. GORDON, D. T., and A. F. SCHMITTHENNER. 1969. Association of soybean mosaic virus with tobacco ring spot virus in soybean bud blight. Phytopathology 59:1028. (Abstr.)

A virus isolated from soybean produced severe bud blight (stem-tip necrosis, dwarfed yellow leaves with

necrotic spots, floral bud proliferation, and delayed maturity) in soybean in the greenhouse. The virus was identified as tobacco ring spot virus (TRSV) by reactions on bean and tobacco. However, after passage of the isolate through squash and cucumber, severe bud blight of soybean could not be produced. Serological tests of the original isolate revealed soybean mosaic virus (SMV). Inoculation of soybean in the greenhouse with TRSV plus SMV produced severe bud blight. Field inoculations of Ford soybean with original isolate (SMV + TRSV) caused severe bud blight when made at 12, 24, and 34 days after planting, but not later. With TRSV alone in a field variety test, only a small percentage of plants showed severe bud blight; about 87% of these plants were affected with SMV also. In assays made on Traverse soybeans with extracts from 485 TRSV-inoculated field soybeans, 118 resulted in severe bud blight; 103 of these contained SMV. It was concluded that severe bud blight of soybean results from infection of TRSV plus SMV.

758. GORDON, W. L. 1956. The taxonomy and habitats of the *Fusarium* species of Trinidad, B.W.I. Canad. J. Bot. 34:854. (Abstr.)

Fusarium semitectum isolated from discolored basal parts of a plant. Lists as synonymous *F. semitectum* var. *majus, F. diversisporum,* and *F. roseum.*

759. GORLENKO, M. V. 1947. A survey of the geographical distribution of bacterial plant diseases in the USSR [in Russian, English summary]. Moscow Obshch. Isp. Prirody, Biull. Sect. Biol. 52(2):61–70.

The bacteria are divided into groups according to their frequency in U.S.S.R. *Bacterium glycineum* (= *Pseudomonas glycinea*) and *B.* (= *Xanthomonas*) *phaseoli sojense* are discussed.

760. GOTH, R. W. 1966. Golden Bantam corn seed, a suitable medium for asexual sporulation of *Cephalosporium gregatum.* Plant. Dis. Reptr. 50:33–35.

Golden Bantam sweet corn seed medium prepared as follows supports luxuriant sporulation of *Cephalosporium gregatum.* Twenty corn seeds, soaked in distilled water for 16 hr., are put in 5 ml distilled water in small glass jars and autoclaved for 30 min. The fungus is cultured at room temperature (18–22 C).

761. GOTO, K. 1925. Miscellaneous notes on the plant diseases found in Morioka. I. [in Japanese]. J. Plant Prot. (Tokyo) 12:677–682.

Records the occurrence of a *Phomopsis* on soybean pods. The fungus resembles the imperfect stage of *Diaporthe sojae* (= *D. phaseolorum* var. *sojae*).

762. GOTO, K., and K. TAKAHASHI. 1926. Miscellaneous notes on the plant diseases found in Morioka. II. [in Japanese]. J. Plant Prot. (Tokyo) 13:154–158.

Records occurrence of a new stem blight caused by *Peckia* sp. Symptoms and morphology of the fungus are briefly described.

763. GOTO, K. 1937. Acceleration of growth in the light case of soybean purple seed. Preliminary report [in Japanese]. Sci. Bull. Alumni Assn. Morioka Coll. Agr. and For. 13, pp. 1–14.

Soybean seeds lightly infected by *Cercosporina* (= *Cercospora*) *kikuchii* grow faster than the healthy ones.

764. GOTOH, A., and Y. OHSHIMA. 1963. *Pratylenchus*-arten und ihre geographische verbreitung in Japan (Nematoda: Tylenchida) [in Japanese, German summary]. Japan. J. Appl. Ent. and Zool. 7:187–199.

Reports *Pratylenchus penetrans, P. neglectus,* and *P. coffeae* in soil around soybean roots. Gives comparative illustrations showing taxonomic differences in species.

765. GOTTLIEB, D., and H. L. POTE. 1960. Tetrin, an antifungal antibiotic. Phytopathology 50:817–822.

Tetrin, produced by *Streptomyces* sp., is nontoxic to soybean when sprayed on leaves, and it reduced infection by *Cercospora sojina.*

766. GOTUZZO, E. 1965. Bacteriosis of soybean in Argentina [English summary]. Revta. Fac. Agron. Vet. Univ. Buenos Aires 15:27–62.

Symptoms and morphological, cultural, and physiological characters are described of *Xanthomonas phaseoli* var. *sojense, Pseudomonas glycinea,* and *P. tabaci,* which occur on soybean in Argentina in this order of importance. All three are transmitted by seeds and plant litter. Inoculation with *P. tabaci* was successful only when there was previous or simultaneous infection by *X. p.* var. *sojense.* The three bacteria often occurred together in the same lesions.

767. GOTUZZO, E., and D. DVEAMPO. 1966. Effect of fungicide applications on the germination of soybean seeds in the greenhouse [English summary]. Revta. Fac. Agron. Vet. Univ. Buenos Aires 16:302.

Of seven fungicides tested, all organic products increased germinability, while two organo-mercuric compounds reduced germinability and retarded growth. Best results were obtained with thiram and kregasan followed by duter.

768. GRABE, D. F., and J. DUNLEAVY. 1959. Physiologic specialization in *Peronospora manshurica.* Phytopathology 49:791–793.

Two new races of *Peronospora manshurica,* causal agent of downy mildew of soybeans, are described. Race 7 was isolated from soybean seeds grown in Illinois. Race 8 was isolated from soybeans grown in Indiana, Missouri, and three locations in Iowa. Proposed for differentiation of races of *P. manshurica* is a set of 14 soybean cultivars:

Illini, Richland, Mukden, Wabash, Pridesoy, Norchief, Laredo, S100, CNS, F.C. 33123, Palmetto, Acadian, Ogden, and Roanoke. Five infection types were established for rating varietal reaction to infection by the fungus. In addition to the isolation of races 7 and 8, race 1 was obtained from seed grown in Arkansas, and race 2 from seed grown in Iowa. Since these two races were originally differentiated on only three cultivars, these descriptions have been amended to include their reactions on the entire set of 14 differentials.

769. GRAHAM, J. H. 1952. New wildfire symptoms on soybean. Plant Dis. Reptr. 36:22.

Reports the isolation of *Pseudomonas tabaci* from discolored pods, stems, and petioles of soybean plants severely infected with wildfire. Irregularly shaped brown lesions occurred on the stems, and brownish spots and streaks were found on the petioles, petiolules, and pulvini. On the pods, infected areas were dark brown and somewhat water-soaked, with occasional lighter-brown necrotic streaks near the margins. Also reports the finding of lesions without the chlorotic zone, believed to be caused by the wildfire organism. Presumes that such lesions are formed when water-congested tissue surrounds the point of infection, and that cells in this area are killed so rapidly by invading bacteria that no chlorosis results. In some instances both *P. tabaci* and *Xanthomonas phaseoli* var. *sojense* were isolated from the same lesion.

770. GRAHAM, J. H. 1952. Preservation of three bacterial pathogens of soybean in culture. Plant Dis. Reptr. 36:22–23.

Reports that *Pseudomonas tabaci* and *P. glycinea* remained viable and highly pathogenic after storage in beef-peptone broth (no dextrose) at 4–8 C for 31 months, provided that mouths of tubes were covered with tin foil. *P. glycinea, P. tabaci,* and *Xanthomonas phaseoli* var. *sojense* remained alive and pathogenic for 29 months on beef-dextrose agar slants covered with sterile mineral oil. The cultures were allowed to grow for 1 day before being covered with oil.

771. GRAHAM, J. H. 1953. Overwintering of three bacterial pathogens of soybean. Phytopathology 43:189–192.

Xanthomonas phaseoli var. *sojense, Pseudomonas glycinea,* and *P. tabaci* were seedborne. Though percentage of initial infection on seedlings from infected seed was low it was sufficient to produce moderately severe disease when weather conditions were favorable. *P. tabaci* and *P. glycinea* were detected in seeds 6 months after harvest but not after 18 months. *X. phaseoli* var. *sojense* was detected in seed 6, 18, and 30 months after harvest. All three persisted in sterile soil for at least 9 months and in field soil through winter, overwintering in leaves on soil surface.

772. GRAHAM, J. H. 1953. Cultural and epiphytotic relationships of three bacterial pathogens of soybeans. Phytopathology 43:193–194.

Numerous examples of the association of *Xanthomonas phaseoli* var. *sojense* and *Pseudomonas tabaci* are cited. Pustule lesions were found on almost all leaves showing wildfire symptoms. *X. phaseoli* var. *sojense* was isolated from most of the young typical wildfire lesions examined. *P. tabaci* infects soybean leaves primarily through pustule lesions. In culture *P. tabaci* produces a diffusible substance antagonistic to *X. phaseoli* var. *sojense* and *P. glycinea.* The antagonistic substance could not be separated from the bacteria by the methods used. Tobacco isolates of *P. tabaci* were similarly antagonistic to *X. phaseoli* var. *sojense* and *P. glycinea.*

773. GRAHAM, T. W., and Q. L. HOLDEMAN. 1953. The sting nematode *Belonolaimus gracilis* Steiner: a parasite on cotton and other crops in South Carolina. Phytopathology 43:434–439.

Typical symptoms of sting nematode damage occurred on soybeans in greenhouse tests. Serious losses may occur in field in South Carolina.

774. GRANCINI, P. 1941. [Il "mosaico" della soja.] Avvenire Agr. Milano 49:231–235.

775. GRASSO, V. 1962. Regeneration of sclerotia of *Sclerotinia sclerotiorum* (Lib.) de Bary [in Italian, English summary]. Staz. di Patol. Veg. (Rome), Boll. Ser. III, 19, pp. 95–101.

In an attempt to induce germination, large sclerotia which were contaminated by bacteria were cut into pieces a few mm thick and transferred to triangular pieces of fresh potato-dextrose agar, though this did not entirely eliminate the bacteria. The parts laid bare by the cuts developed new pseudoparenchymata and formed one or two small sclerotia. When the process was complete, mycelium grew rapidly over the medium and gave rise to numerous sclerotia on the periphery. Sclerotia from another locality and grown in cultures without bacterial contamination failed to regenerate.

776. GRAU, C. R., and C. A. MARTINSON. 1971. Inhibition of soybean hypocotyl elongation by *Rhizoctonia solani.* Phytopathology 61:1023. (Abstr.)

Rhizoctonia solani inhibits soybean hypocotyl elongation when used at moderate inoculum levels. This phenomenon is exhibited when seedlings are grown in vermiculite or natural soil infested with *R. solani.* Hawkeye soybeans were used because of their rapid emergence. Seedlings were grown in plastic vegetable crispers in a growth chamber at five temperatures ranging from 20–30 C in total darkness. The degree of inhibition was a function of temperature and inoculum density when compared to healthy controls; optimum temperature for inhibition of hypocotyl elongation was 25 C. The amount of inhibition

varied with different *R. solani* isolates. The seed coats were colonized within 24 hr. after planting, and the degree of inhibition was correlated with length of time the seed coat remained attached to the cotyledons. Hypocotyl lesions sometimes formed were not necessarily associated with the inhibition phenomenon.

777. GRAU, C. R., and H. L. BISSONNETTE. 1974. Whetzelinia stem rot of soybean in Minnesota. Plant Dis. Reptr. 58:693–695.

In greenhouse, inoculated susceptible plants were completely destroyed. Symptoms in the field occurred when plant growth was sufficient to close the rows. Leaf wilting was the first symptom. Most infection of main stem was above the soil level. Occasionally sclerotia were present externally on the stem. Water-soaked lesions were present on branches but not on pods. Symptoms were not present on roots. Cultivars Norman, Corsoy, Dunn, Beeson, Portage, Harosoy, and Wilth showed resistance.

778. GRAY, G., W. L. KLARMAN, and M. L. BRIDGE. 1968. Relative quantities of antifungal metabolites produced in resistant and susceptible soybean plants inoculated with *Phytophthora megasperma* var. *sojae* and closely related nonpathogenic fungi. Canad. J. Bot. 46: 285–288.

Resistant Harosoy 63 plants produced seven times as much fungal inhibitor as susceptible Harosoy when both were inoculated with soybean pathogen *Phytophthora megasperma* var. *sojae*. When the challenging fungus was a nonpathogenic variety of *P. megasperma,* Harosoy 63 produced only twice as much inhibitor as Harosoy. A closely related fungus, *P. cactorum,* also nonpathogenic on soybean, stimulated equal amounts of inhibitor in both varieties. The three *Phytophthora* isolates did not differ significantly in ability to stimulate inhibitor in Harosoy 63, but in Harosoy, both isolates of *P. megasperma* stimulated significantly less inhibitor than did *P. cactorum.* Inhibitor from the interaction of *P. megasperma* var. *sojae* × Harosoy 63 was most inhibitory to *P. megasperma* and least inhibitory to *P. cactorum.*

779. GRAY, L. E., P. N. THAPLIYAL, and J. B. SINCLAIR. 1970. A rating system for determining soybean yield reductions by *Cephalosporium gregatum.* Phytopathology 60:1024.

A three-class system for field surveys of brown stem rot of soybeans is proposed. Class 1, no stem browning; class 2, stem browning up to first node; and class 3, stem browning 6 in. above the first node. On the basis of the rating system, plants rated in the third class yielded significantly less than plants in the first and second class. Losses up to 20% were determined.

780. GRAY, L. E., and J. B. SINCLAIR. 1970. Uptake and translocation of systemic fungicides by soybean seedlings. Phytopathology 60:1486–1488.

Five fungicides known to be systemic in plants other than soybean: benomyl; chloroneb (demosan); DCMOD (plantvax); and DMOC (vitavax) were fungitoxic to soybean pathogens: *Diaporthe phaseolorum* var. *caulivora; D. phaseolorum* var. *sojae; Cercospora kikuchii;* and *Cephalosporium gregatum* in vitro. TBZ was fungitoxic to *D. phaseolorum* var. *sojae.* TBZ was not evaluated against the other three pathogens. Some fungitoxic component of benomyl, chloroneb, and TBZ moved systemically in soybean seedlings after seedling roots were exposed to the chemicals. It was not ascertained whether the specific fungicide or a compound related to it accounted for fungitoxicity in treated seedling tissues. DCMOD and DMOC were phytotoxic at the levels tested, and could not be bioassayed for systemic activity. Benomyl and TBZ tended to accumulate in the cotyledons of treated seedlings but not in the hypocotyl tissues. This may account, in part, for the general lack of success in using these fungicides as seed and soil treatments for disease control in soybean seedlings.

781. GRAY, L. E., and J. B. SINCLAIR. 1971. Systemic uptake of ^{14}C-labeled 2-(4′-thiazolyl) benzimidazole in soybean. Phytopathology 61:523–525.

Direct evidence of uptake and translocation of thiabendazole (TBZ) was obtained using ^{14}carbon-labeled TBZ and nonlabeled TBZ. Both compounds were absorbed by roots of soybean seedlings and appeared to move unaltered into all aboveground tissues. The accumulation of ^{14}C-TBZ increased in epicotyl and root tissues with increase in exposure time, while radioactivity in hypocotyl tissues was not affected by exposure time. TBZ was fungitoxic for *Cephalosporium gregatum* both in vitro and in vivo. TBZ, used as a soil drench in clay pots (25 ml of 200 $\mu g/g$ in 750 g soil), restricted the development of internal browning in soybeans that were wound-inoculated with *C. gregatum* when plants were 8 weeks old. The fungus could not be reisolated from treated plants.

782. GRAY, L. E. 1971. Variation in pathogenicity of *Cephalosporium gregatum* isolates. Phytopathology 61: 1410–1411.

Variation in pathogenicity of isolates of *Cephalosporium gregatum* is of two types. Type I isolates caused wilt symptoms on soybean cultivar Clark 63, and Type II isolates caused vascular browning but not wilt symptoms. On resistant cultivar P.I.84.946-2, Type I isolates also caused more extensive vascular discoloration than did Type II isolates.

783. GRAY, L. E. 1972. Effect of *Cephalosporium gregatum* on soybean yield. Plant Dis. Reptr. 56:580–581.

Soybean plants inoculated with a defoliating isolate of *Cephalosporium gregatum* yielded 38% less than nonin-

oculated control plants. Severe defoliation symptoms were present on inoculated plants 3 weeks before maturity. When soybeans were inoculated with a defoliating and nondefoliating isolate of *C. gregatum,* only the defoliating isolate significantly reduced yields compared with control plants.

784. GRAY, L. E. 1972. Recovery of *Cephalosporium gregatum* from soybean straw. Phytopathology 62:1362–1364.

Cephalosporium gregatum was recovered from overwintered soybean straw when the straw was ground in a Wiley mill and the resulting material was incubated at 18 C for 5 days on water agar containing tetracycline HCl and streptomycin sulfate. Sporulation of the fungus on soybean stems in the field was noted up to mid-November but thereafter was observed rarely, presumably because saprophytic microorganisms disintegrated the cortical tissue. Spores of the pathogen were not detected with soil dilutions but the fungus was recovered frequently with stem fragments. The fungus survives in soil within the woody stem tissue, which probably serves as the source of inoculum.

785. GRAY, L. E., and J. B. SINCLAIR. 1973. The incidence, development, and yield effects of *Cephalosporium gregatum* on soybeans in Illinois. Plant Dis. Reptr. 57:853–854.

Brown stem rot of soybean occurred in 19 of 30 fields sampled in 1970 and in 32 of 54 fields in 1972. Stem browning appeared 8 weeks after soybeans were planted in soil infested with *Cephalosporium gregatum.* Yields were reduced 25 and 31% in inoculated Beeson and Calland soybean cultivars, respectively, in 1972. All ten soybean lines that have been used for development of commercial soybean cultivars in Illinois were susceptible to the defoliating strain of *C. gregatum.*

786. GRAY, L. E. 1974. Role of temperature, plant age, and fungus isolate in the development of brown stem rot in soybeans. Phytopathology 64:94–96.

Temperature and plant age were not limiting factors preventing leaf symptoms in soybean plants inoculated with a defoliating isolate of *Cephalosporium gregatum.* Soybean plants inoculated with this isolate of the fungus were defoliated at 22 and 28 C. Only the defoliating isolate produced characteristic leaf symptoms on plants inoculated in the field.

786a. GRAY, L. E., and D. W. CHAMBERLAIN. 1974. Evidence for toxin production by an isolate of *Cephalosporium gregatum.* Proc. Amer. Phytopath. Soc. 1:92. (Abstr.)

An investigation was made to explain the action of an isolate of *Cephalosporium gregatum* (Type I) which induces defoliation in infected plants, in contrast with Type II (ATCC) isolate which does not induce defoliation. Extracts were made from stems of infected plants by homogenizing 15 g of stem segments in 200 ml distilled water in a blender. The homogenate was strained through a clarifying filter, autoclaved, cleared by centrifugation, and sterilized by filtration. Detached trifoliolate soybean leaves (cultivar Chippewa 64) placed in Type I filtrate wilted and died; those in Type II filtrate did not. Both extracts caused vascular browning in the petioles. Leaves of susceptible cultivars Amsoy 71, Beeson, Calland, and Wayne wilted within 3 days in Type I extract, whereas leaves from resistant PI 86,150 did not. Wilting was not attributable to vascular plugging. The Type I isolate also produced the wilt-inducing material in vitro when grown for 3 weeks in soybean-stem broth (25 g stems homogenized in 200 ml distilled water, strained through cotton, and added to 800 ml distilled water). It is suggested that a toxin produced by Type I isolates of *C. gregatum* is responsible for the leaf-wilting and defoliation described in this abstract.

786b. GRAY, L. E. 1974. Reaction of soybean lines to a defoliating strain of *Cephalosporium gregatum.* Proc. Amer. Phytopath. Soc. 1:93. (Abstr.)

Reaction of soybean lines to a defoliating strain of *Cephalosporium gregatum* were evaluated in the greenhouse in 1971–1973 and in the field in 1972–1973. Resistant soybean cultivars PI 84946-2 and PI 86150 were stem-inoculated in the greenhouse alone with susceptible Clark and Harosoy. Four weeks after inoculation PI 84946-2 and PI 86150 showed no leaf symptoms. Clark and Harosoy cultivars had severe leaf necrosis and were killed 5 weeks after inoculation. Clark, PI 84946-2, and two resistant selections from a cross of Clark × PI 84946-2 plants were stem-inoculated at 14 days after planting. All Clark plants showed severe leaf symptoms. Five weeks after inoculation no leaf symptoms were evident on PI 84946-2 plants. Both selected Clark lines had some leaf symptoms on the lower first and second trifoliolate leaves but symptoms did not extend to the terminal developing leaves as was evident in Clark. Clark, PI 84946-2, PI 86150, and a resistant selection from a cross of Clark × PI 84946-2 were stem-inoculated in the field 7 weeks after planting. Only the inoculated Clark plants showed leaf symptoms 5 weeks before maturity.

787. GREEN, H. C. 1949. Notes on Wisconsin parasitic fungi. Amer. Midl. Natl. 41:714–758.

The ubiquitous saprophyte *Epicoccum neglectum* has repeatedly been found in Wisconsin on wilting soybean leaves under conditions suggesting that it may sometimes act as a weak parasite.

788. GREEN, R. J., JR. 1967. Control of Verticillium wilt of peppermint by crop rotation sequences. Plant Dis. Reptr. 51:449–453.

Under greenhouse conditions, in soils heavily infested

with *Verticillium albo-atrum,* soybean cultivar Harosoy proved susceptible. The fungus was recovered from roots, and stem vascular systems. Infected plants were stunted and showed chlorosis, defoliation, and premature death.

789. GRIJSEELS, A. J., E. B. WILLIAMS, and J. KUĆ. 1964. Hypersensitive response in selections of *Malus* to fungi nonpathogenic to apple. Phytopathology 54:1152–1154.

Helminthosporium carbonum incited hypersensitive response when inoculated in soybeans.

790. GROVES, J. W., and A. J. SKOLKO. 1945. Notes on seed-borne fungi. II. *Curvularia.* Canad. J. Res., Sect. C, Bot. Sci. 23:94–104.

Curvularia trifolii was isolated from soybean seed but appeared to have no pathological significance.

791. GRUJICIC, G., and B. TOMASEVIC. 1956. Diseases and pests of cultural plants observed in the period of twenty years (1934–1953) [in Croatian, English summary]. Zashtita Bilja 38:87–106.

The Information Service for Plant Protection in Yugoslavia reported that *Bacterium* (= *Xanthomonas*) *phaseoli* was found at Rumi and Leskovc in 1934, at Belgrade and Sapcu in 1941, and at Krusevc in 1946, and *B. glycineum* (= *Pseudomonas glycinea*) was found in Belgrade in 1940.

792. GUERPEL, H. 1937. [Les ennemis et les maladies du soja.] Rev. Bot. Appl. 17:195–201.

A brief review of some insect pests and diseases affecting soybeans.

793. GUIRAN, G. D. 1970. Le probleme *Meloidogyne* sur tabac a Madagascar [English summary]. Cah. O.R.-S.T.O.M., Ser. Biol. No. 11, pp. 187–208.

Soybean was found to be highly resistant to populations of *Meloidogyne javanica* and *M. incognita.* Soybean could be used in rotations to reduce nematode populations. Checking for possible build-up of aggressive biotypes of the nematodes is recommended.

794. GUSTAVSSON, A. 1959. Studies on Nordic *Peronosporas.* I. Taxonomic revision. Opera Bot. 3(1):1–271.

The known distribution of *Peronospora manshurica* is Sweden, Denmark, Great Britain, Rumania, Russia, Yugoslavia, South Africa, China, India, Japan, Philippines, Bermuda, Canada, and United States.

795. HAAS, J. H. 1964. Isolation of *Phytophthora megasperma* var. *sojae* in soil dilution plates. Phytopathology 54:894. (Abstr.)

Studies of the occurrence and behavior of *Phytophthora* and *Pythium* spp. have been retarded because they have not been isolated on soil dilution plates. Although an antibiotic medium has been developed for isolating these fungi from plant tissue, direct isolations from soils have failed. A modification of the medium, so far used only for isolating *Phytophthora megasperma* var. *sojae,* has been developed. Difco corn-meal agar is supplemented with pimaricin (2 ppm), penicillin "G" (80 units/ml), polymixin B (370 units/ml), and pentachloronitrobenzene (10 ppm); pH is adjusted to 4.6 with lactic acid. The concentration of pimaricin is critical. Direct isolation from soil is prevented at doses of pimaricin higher than 2 ppm even though *Phytophthora,* transferred from pure culture, grows at 100 ppm. Acceptable restriction of other fungi is not attained with $<$ 2 ppm pimaricin. Screened soil ($<$ 2 mm) is diluted 1:1,000 in 0.1% water agar. Each plate receives 0.5 ml. Mixing liquid agar (42 C) with soil in petri plates yields more colonies than distributing the soil on solid agar. Isolations from soybean rhizosphere were successful, but the fungus was seldom obtained from soil in which recently infected plants were not growing. Oospores have not been found germinating on the medium.

796. HAENSELER, C. M. 1946. Soybean diseases in New Jersey. New Jersey Agr. Expt. Sta. Plant Dis. Notes 23, pp. 17–20.

Pod and stem blight (*Diaporthe phaseolorum* var. *sojae*) causes a marked reduction in yield due to premature killing of the plants. Mosaic and downy mildew (*Peronospora manshurica*) are of rare occurrence. Purple-seed disease was proved to be caused by a fungus.

797. HAENSELER, C. M. 1947. Pathologist describes four principal diseases of field soybeans in Jersey. New Jersey Agr. 29(3):4.

A brief popular account on the effects and symptoms of mosaic, downy mildew (*Peronospora manshurica*), pod and stem blight (*Diaporthe phaseolorum* var. *sojae*), and purple-seed disease caused by an unspecified fungus.

798. HAGEDORN, D. J., and J. C. WALKER. 1949. Wisconsin pea streak. Phytopathology 39:837–847.

Soybean was infected by inoculation with the pea streak virus, producing very faint general chlorosis.

799. HAGEDORN, D. J. 1950. A cucumber virus strain with a wide leguminous host range. Phytopathology 40: 11. (Abstr.)

A new strain of cucumber virus 1 infected soybeans upon sap inoculation.

800. HAGEDORN, D. J., and J. C. WALKER. 1950. The relation of bean virus 2 to pea mosaic in Wisconsin. Phytopathology 40:684–698.

Four isolates of bean virus 2 from pea can infect soybean. One isolate produced local necrosis, but virus could not be recovered from local lesions. The infection was sys-

temic, because the virus was recovered from upper chlorotic leaves.

801. HAGGE, A. H. 1969. Soybean cyst nematode damage as associated with the intensive culture of soybeans in southeastern Missouri. Spec. Rpt. Iowa State Univ. Sci. Technol. No. 64, pp. 41–48.

The soybean-cyst nematode (*Heterodera glycines*), first found in North Carolina in 1954, now infests an estimated 2 million acres in 9 states. Most of the known infested acres are in a large commercial soybean-growing area in Arkansas, Illinois, Indiana, Kentucky, Mississippi, Missouri, and Tennessee and in the Ohio and Mississippi river valleys. Damage in this 8-state area increased spectacularly from a minor loss in 1958 to an estimated loss of more than $9 million in 1965 and $8 million in 1966. Loss in Missouri, which increased from an estimated 23,900 bu. in 1959 to 1,160,000 bu. in 1966, appears associated with successive planting and limited rotation of soybeans. New improved cultivars Pickett, Custer, and Dyer have been developed for resistance to the nematode. Areas infested are under state-federal quarantine.

802. HALK, E. L., and J. M. MC GUIRE. 1973. Certain aspects of the translocation of tobacco ring spot virus in soybean. Phytopathology 63:442. (Abstr.)

An abstract of entry 803.

803. HALK, E. L., and J. M. MC GUIRE. 1973. Translocation of tobacco ring spot virus in soybean. Phytopathology 63:1291–1300.

Tobacco ring spot virus (TRSV) moved from top leaves to roots of young soybean in 2 to 3 days, but upward translocation of TRSV from roots or lower stem occurred only under certain conditions. Soybean seedlings inoculated below the first node became systemically infected only if inoculated before they were 12 days old. Inoculation between the first and second nodes gave similar results except that some systemic infections occurred when plants were 17 days old at inoculation. The number of plants that became systemically infected increased with time after inoculation at a given age. Upward translocation of TRSV was slowed at the first and second nodes in soybean seedlings. Major vascular bundle traces in lower stems of seedlings terminated at the first or second nodes. Additional traces which were continuous through both nodes developed as the plant grew.

In older plants, the major direction of virus movement in the stem below the midpoint of the plant was downward; whereas, virus was translocated both upward and downward when inoculated above the midpoint of the plant. There was no upward or downward movement of TRSV in xylem. Sieve tubes in the stem below the second node of systemically infected plants, which had been inoculated below the first node, contained crystals and aggregates of TRSV, and aggregates also occurred in companion cells, vascular parenchyma cells, and bundle sheath cells. Virus particles in the plasmodesmata, enlarged plasmodesmata containing clumps of virus particles, and cell wall protrusions enclosing tubules containing virus particles were also observed in these cells. It is suggested that cell-to-cell movement of TRSV from inoculated areas to phloem sieve tubes, and long-distance translocation of the virus in the phloem, cause systemic infection of soybean with TRSV.

804. HAMBLEN, M. L., and D. A. SLACK. 1959. Factors influencing the emergence of larvae from cysts of *Heterodera glycines* Ichinohe. Cyst development, condition, and variability. Phytopathology 49:317. (Abstr.)

In greenhouse and laboratory studies, development of cysts and emergence of larvae from cysts were influenced by the moisture condition of soil in which soybean plants were growing prior to collection of cysts. A higher percentage of brown cysts and significantly greater emergence of larvae from brown cysts was correlated with moisture stress on soybean plants during a 2-week period preceding the recovery of cysts from soil. Adequate or excessive soil moisture for growth of soybean plants resulted in a high percentage of so-called white or yellow cysts as compared to brown cysts, and less emergence of larvae from brown cysts recovered from the soil. The degree of cyst maturity and the condition of brown cysts influenced the number of larvae that emerged. In decreasing order of the number of larvae that emerged, cyst designations were: (1) white cysts, (2) brown floaters that would not sink in water, (3) yellow cysts, and (4) brown sinkers. Although the total number of larvae that emerged from a collection of brown cysts was frequently high, considerable variability occurred in larval emergence from single selected cysts. In several tests, about 90% of the total emerged larvae were attributable to 10% of the cysts. Rupture of the brown cysts following the tests revealed numerous eggs with developed larvae, and some hatched larvae in all cysts.

805. HAMBLEN, M. L., D. A. SLACK, and R. D. RIGGS. 1972. Temperature effects on penetration and reproduction of soybean cyst nematode. Phytopathology 62:762. (Abstr.)

Penetration and reproduction of *Heterodera glycines* was determined in Lee soybean and other plants grown in sand in plastic cups in controlled temperature tanks. Inoculations were made with eggs and larvae prior to the placing of plants in the tanks, or after 48 hours at the desired temperature in the penetration studies. One day after inoculation, four times as many nematodes were found in roots at 28 C as at 22 C, which was second highest, and after 14 days there were 12 times as many at 28 C. White females were recovered earliest (14 days) at 28 and 31 C, but not until 58 days at 14 C. Little penetration and no maturation occurred at 35 C. Males were recovered first (14 days) at 22, 24, 28, and 31 C,

and were never recovered at 14 and 35 C. New larvae were first found (22 days) at 28 C, and were never found at 14, 33, and 35 C. Varying the temperature reduced the number of *H. glycines* maturing in 42 days on Lee soybean. Temperature did not change the resistance of Peking soybean or Doark vetch. The optimum temperature for reproduction on *Lupinus albus* and *Vigna willmsii* was 22 C.

806. HAMILTON, R. I., and M. G. BOOSALIS. 1955. Asexual reproduction in *Cephalosporium gregatum*. Phytopathology 45:293–294.

Report a budding type of conidial germination. Sporulating and nonsporulating strains were isolated after the organism had grown in shake culture. Temperatures between 14.5 and 21.0 C promoted sporulation; no fruiting was recorded at temperatures above 29.0 C; pH 5 and 6 favored sporulation in the sporulating type but did not influence the nonsporulating type. Soybean stem agar induced sporulation in the nonsporulating type. Budding took place only on water agar.

807. HAMMERSCHLAG, F., and W. L. KLARMAN. 1969. An antifungal principal produced by soybean plants inoculated with tobacco necrosis virus. Phytopathology 59:1557. (Abstr.)

An abstract of entry 1111.

808. HAN, Y. H. 1970. Factors affecting the activity of pectic enzymes produced by *Thanataphrous cucumeris* (Frank) Donk. from soybean plant. J. Agr. and For. 21:1–11.

Pectic enzyme activities of *Thanataphrous cucumeris* was studied in soybean leaf tissues and culture filtrate. The fungus produces pectinmethylesterase (PME) and polygalacturonase (PG). PG activity was greater in infected leaves than noninfected leaves and was believed to be one of the primary enzymes. PME may be secondary in pathogenesis perhaps not associated with host tissue degradation. Temperature 28–32 C and pH 5.0–5.5 are optimum for maximum enzyme production in the culture. Nutritional sources favoring enzyme production are given.

809. HAN, Y. H., and D. MURAYAMA. 1971. Studies on soybean mosaic virus. I. Separation of virus strains by differential host. J. Fac. Agr. Hokkaido Univ. 56:303–310.

Several isolates of soybean mosaic virus (SMV) collected from Taiwan were tested and compared with typical isolates obtained in Japan. Six strains of SMV were found from soybeans in Taiwan and designated as SMV-T1, SMV-T2, SMV-T3, SMV-T4, SMV-T5, and SMV-T6. Host ranges of these six strains are quite similar but not identical to Japanese strains. Transmission studies with SMV isolates indicated considerable variability in symptom expression in soybean and certain specific differences in host range. The isolates can be divided into two groups, differing in virulence. Foliage symptoms induced by mild strains include veinclearing and mosaic. Severe strains reduce leaf size and produce stunting and necrosis in upper parts of infected plants.

810. HAN, Y. H., and D. MURAYAMA. 1971. Studies on soybean mosaic virus. II. Purifications and some properties of the virus. J. Fac. Agr. Hokkaido Univ. 56:311–322.

Soybean mosaic virus (SMV) was purified by a modification of the method described by Ross. The purified virus was very high in purity as determined from serological tests and analytical ultracentrifugation. Virus preparation had an ultraviolet absorption with a maximum at 260 mμ and minimum at 245 mμ. The maximum/minimum ratio was 1.14:1.38, and 280/260 mμ ratio was 0.64:0.74. The Schlieren pattern obtained by analytical ultracentrifugation showed only one peak. The sedimentation coefficient of SMV is about 143S. The electrophoretic pattern of the virus on Searax gave only one boundary with a mobility of $10^3 \times 5.5$ cm/min.

811. HAN, Y. S. 1959. Studies on purple spot of soybean. J. Agr. and For. 8:1–32.

Purple spot disease is widespread in Taiwan. Symptoms on seed, leaf, stem, and pod are described and illustrated. Morphology of *Cercospora kikuchii* is also described and illustrated. The fungus reduces seed germination. It grows best at 25 C and conidia germinate readily in tap and distilled H_2O at 25 C. Abundant rainfall increases disease severity. Leaves become susceptible with increasing age. Cultivars such as Pingtung Green Bean, Acadian, Pingtung-chu-tzu-tou, Improved Pelican, Manchu, Kaohsing #1 and #19, Black Bean, Kanto #13, Bilofield, Chichibu musheachin, Dortchsoy 2 gr 2, Hale, Ogden gr 1, Mandarin, Seminole T, and M. 3234 were resistant. Fungicides dithane-M22 and phygon XL greatly reduced disease incidence and increased yield.

812. HAN, Y. S. 1959. Soybean diseases in Taiwan [in Chinese, English summary]. Agr. Assoc. China (Taiwan) J. (n. s.) 26:31–38.

A general survey of 150 cultivars in Taiwan showed that soybean dwarf and mosaic were common virus diseases. Bacterial blight (*Pseudomonas glycinea*) and bacterial pustule (*Xanthomonas phaseoli* var. *sojense*) were most widespread. Purple seed stain (*Cercospora kikuchii*) was considered as destructive. Downy mildew (*Peronospora manshurica*) caused serious damage in wet weather. Sclerotial blight (*Sclerotium rolfsii*), frog-eye leaf spot (*Cercospora sojina*), rust (*P. sojae*), anthracnose (*Colletotrichum glycines* = *C. dematium* f. *truncata*), Fusarium pod rot (*F. oxysporum* f. *tracheiphilum*), Sclerotinia rot (*S. sclerotiorum* = *W. sclerotiorum*), seed rot (*F. scirpi* f. *tracheiphilum*), brown spot (*Alternaria* sp. *Helminthosporium* sp.), violet rot (*Helicobasidium*

monpa) and pod blight (*Macrophoma mame*) occurred in various degrees of severity. Cultivars Ogden, Dortchsoy 2, Palmetto, CNS, and E.G.I. possessed greatest relative resistance to bacterial pustule and bacterial blight.

813. HAN, Y. S. 1966. Banded sclerotial blight of soybean caused by *Pellicularia sasakii* (Shirai) Ito in Taiwan. Plant Prot. Bull. Taiwan 8:101–118.

The disease caused by *Pellicularia sasakii* is characterized by appearance of large irregular water-soaked spots on leaves and pods, basal stem rot, and blight of aerial parts. Pathogenicity of rice isolates was lower than soybean isolate on soybeans. Optimum temperature for growth of fungus and disease development is 28–30 C. Optimum pH of medium for growth is 6.5–7.0. Soil moisture of 80–90% favored mycelial growth through soil. Seed germination in soil is inhibited if soil moisture is above 53%. Seedling mortality is highest at soil moisture 53–94%. Cultivars Chih-Chia, Wusheh, Black Bean, Jackson, Fang-Cheng, and Tanner are resistant.

814. HANLIN, R. T. 1963. A revision of the Ascomycetes of Georgia. Georgia Agr. Expt. Sta. Ser. (n.s.) 175. 67 pp. (Mimeo.)

Records on soybeans: *Diaporthe phaseolorum* var. *sojae, Glomerella glycines,* and *Mycosphaerella cruenta.*

815. HANSFORD, C. G. 1934. Annual report of mycologist, 1933. Dept. Agr. Uganda Ann. Rpt. 1933, Part 2, pp. 48–51.

Soybean showed a mosaic condition unaccompanied, however, by any diminution in yield.

816. HANSFORD, C. G. 1943. Host list of the parasitic fungi of Uganda. II. East African Agr. J. 9:50–55.

Lists the occurrence of the following organisms on *Glycine* spp.: *Aphysa rhynchosiae, Cercospora cruenta, Meloila bicornis, Rhizoctonia bataticola* (= *Macrophomina phaseolina*), and *Woroninella dolchi.*

817. HANSON, E. W. 1938. Parasitism and physiologic specialization in *Fomes lignosus.* Phytopathology 28:8. (Abstr.)

Fomes lignosus is pathogenic to soybeans by artificial inoculation.

818. HARA, K. 1915. Spot disease of soybean [in Japanese]. Agr. Country 9:28.

A brief description of a new leaf spot disease of soybean caused by *Cercospora sojina* n.sp.

819. HARA, K. 1918. Diseases of soybean [in Japanese]. Agr. Country 12:18.

Describes a pod blight caused by *Fusarium roseum* (?) and a leaf spot caused by *Ascochyta* sp.

820. HARA, K. 1928. Notes on fungi of eastern Asia [in Japanese]. Bull. Agr. Assn. Shizuoka No. 360, Appendix.

Includes a short note on *Mycosphaerella sojae* found in China.

821. HARA, K. 1930. Pathologia agriculturalis plantarum [in Japanese]. Tokyo. 950 pp.

Includes descriptive accounts of the following soybean pathogens: *Peronospora manshurica, Cercospora sojina, Colletotrichum glycines* (= *C. dematium* f. *truncata*), *Gloeosporium* sp., *Septoria glycines, Ascochyta* sp. causing leaf spot, *Phakopsora pachyrhizi, Fusarium roseum, Bacterium glycines, B. sojae* var. *japonicum* (= *Pseudomonas glycinea*), *Ascochyta* sp. causing pod blight, *Hypochnus centrifugus, Cercospora kikuchii,* brown spot of seeds of unknown cause, *Macrophoma mame, Mycosphaerella sojae, Phyllosticta sojaecola, Ascochyta sojae, Phomopsis sojae, Peckia* sp., *Ophionectria sojae,* mosaic, *Heterodera schachtii,* and *Cuscuta chinensis.*

822. HARLAN, D. P., and L. JENKINS. 1966. Elimination of soybean cyst nematodes from the roots of plants by chemical dips. Plant Dis. Reptr. 50:548–549.

Cysts of *Heterodera glycines,* which had either been extracted from soil and mixed with sterile sand and sandy-loam soil or were still attached to soybean roots, were dipped for 30 min. in water solutions of nematicides. Checks for nematode survival were made by incorporating dipped material into pots planted with a susceptible soybean cultivar. Solution of 0, 0-diethyl 0-2-pyrazinyl phosphorothioate at 2,530 μg/ml (20 cc/gal.) eliminated the soybean-cyst nematode in pot tests.

823. HARNISH, W. N., and W. G. MERZ. 1964. The effect of beta-sitosterol on oospore production by species of *Phytophthora.* Phytopathology 54:747. (Abstr.)

Addition of the compound to glucose-asparagine agar induced oospore formation in *P. megasperma* var. *sojae.*

824. HARRIS, H. B., M. D. JELLUM, and C. W. KUHN. 1970. Effect of cowpea chlorotic mottle virus (soybean strain) on chemical composition of Davis soybeans. J. Agr. Food Chem. 18:911–912.

The effects of a strain of cowpea chlorotic mottle virus (designated CCMV-S) on total seed oil, protein, and fatty acid composition of oil from Davis soybeans grown in 1968 and 1969 was studied. Infection in inoculated plots was approximately 100% both years with no detectable spread of the disease to inoculated plots. Early seedling infection with CCMV-S reduced total oil and increased protein percentage. Infection with CCMV-S reduced the percentage of palmitic, linoleic, and linolenic acids and increased the percentage of stearic and oleic acids. On a yearly basis, the only significant change in oil composition due to CCMV-S infection was a decrease in linoleic acid in 1968, while palmitic and linolenic acids were decreased and stearic and oleic were

increased in 1969. Although changes in chemical composition due to CCMV-S infection were significant, these changes were small and would not greatly affect the commercial value of infected soybeans.

825. HARRIS, H. B., and C. W. KUHN. 1971. Influence of cowpea chlorotic mottle virus (soybean strain) on agronomic performance of soybeans. Crop Sci. 11: 71–73.

Symptoms produced by the soybean strain of cowpea chlorotic mottle virus on soybean Davis were leaf mottling with light and dark green areas, reduced plant height and vigor, slightly crinkled leaves, and a tendency for leaves to be abnormally upright. Yields from inoculated plants were reduced by 20–31%. Seed quality was affected and seed weight was reduced. On inoculation local necrotic lesions appeared on 18 resistant cultivars and systematic mottling on 7 susceptible cultivars. Veinal necrosis appeared on one cultivar.

826. HARRIS, M. R., and C. W. ELLETT. 1945. A Penicillium disease of soybeans. Phytopathology 35:144–145.

An undetermined species of *Penicillium* was isolated from two types of lesions on soybean in Ohio. Inoculation of seeds with the mold resulted in the production of lesions on hypocotyls and cotyledons, retarded germination, stunting of seedlings, distortion and reduction of size of leaves, and sometimes in the development of lateral buds. All 8 cultivars tested were susceptible.

827. HARRISON, B. D., and A. F. MURANT (eds.). CMl/AAB description of plant viruses. Set 5, sheets 81–95.

Description of soybean mosaic virus.

828. HART, W. H. 1959. Nematodes in plant quarantine. California Agr. 13(9):4–5.

A popular article. The soybean-cyst nematode, although it does not occur in California, is a serious pest of soybeans in the Mississippi Valley and in some southeastern states.

829. HARTWIG, E. E., and S. G. LEHMAN. 1951. Inheritance of resistance to the bacterial pustule disease in soybeans. Agron. J. 43:226–229.

The CNS cultivar was found to be highly resistant or nearly immune to *Xanthomonas phaseoli* var. *sojense*. Resistance is simple recessive and conditioned by a single major gene pair modified by other genes.

830. HARTWIG, E. E., and H. W. JOHNSON. 1953. Effect of bacterial pustule disease on yield and chemical composition of soybeans. Agron. J. 45:22–23.

Eighteen advanced F_6 lines of soybeans in the F_7 generation, resistant to bacterial pustule disease, were compared with 18 similar susceptible lines. All 36 lines traced to one F_2 plant selected from the cross Ogden × CNS. The comparisons were made at Stoneville, Miss., and at Willard, N.C. At both locations a moderate but uniform infection of the bacterial pustule disease developed on susceptible lines. Under these conditions, susceptible lines yielded 11% less than resistant lines at Stoneville and 8% less at Willard. However, susceptible lines produced seed only 3% smaller than resistant lines at Stoneville and 4% smaller at Willard. The difference between resistant and susceptible lines for seed yield and seed size was significant at the 1% level of probability at each location. To account for the yield reduction of the susceptible lines, it is necessary to assume a reduction in seed number along with the reduction in seed size. Seed of resistant lines was higher in protein content than those of susceptible lines. Differences in oil content were nonsignificant at both locations, while the iodine number of the oil of the susceptible group was significantly above that of the resistant group at Stoneville.

831. HARTWIG, E. E. 1959. Effect of target spot on yield of soybeans. Plant Dis. Reptr. 43:504–505.

Differences in yield between three susceptible and three resistant lines of soybeans under moderately heavy target spot (*Corynespora cassicola*) development were highly significant. With light infection the differences were nonsignificant. In defoliation experiments, removal of all leaves 21 days prior to normal maturity resulted in a yield reduction of 29%, and a 17% reduction when leaves were removed 14 days prior to normal maturity. Yield reduction from target spot seems to approximate the yield reduction to be expected from the defoliation that it causes.

832. HARTWIG, E. E. 1960. Soybean varieties, diseases, and practices in the midsouth. Soybean Dig. 20-(6):16–17.

A popular article.

833. HARTWIG, E. E. 1967. Soybean cyst nematodes — a problem and a solution. Natl. Soybean Crop Imp. Council, Urbana, Ill. Soybean News 19:3–4, 6.

Background, symptoms, and early control measures are discussed for the soybean-cyst nematode. In Wilmington, N.C., a field planting with 3,500 soybean strains was made in infested soil. Strains appearing resistant were replanted in North Carolina and in greenhouse plots in Jackson, Tenn., to test them against the Tennessee isolate of the nematode. Peking and P.I. 90763 were highly resistant; Illsoy was moderately resistant. Breeding programs were set up in Mississippi, using these two strains. Coat color was found linked with one of the three recessive genes for resistance. Cultivars Pickett, Custer, and Dyer were developed through state and federal cooperative research. Custer and Dyer differ in their resistance to diseases and other nematodes, and in

date of maturity. This pest is spreading despite quarantines.

834. HARTWIG, E. E., B. L. KEELING, and C. J. EDWARDS. 1968. Inheritance of reaction to Phytophthora rot in the soybean. Crop Sci. 8:634–635.

Inheritance of reaction to races 1 and 2 of *Phytophthora megasperma* var. *sojae* in soybeans was studied. Results obtained from crosses between D60-9647, which is resistant to race 1 and susceptible to race 2 (rps^2 rps^2); Hood, which is susceptible to both races (rps rps); and Semmes, which is resistant to both races (Rps Rps); indicate that Rps, rps^2, and rps form an allelomorphic series. Rps is dominant to rps^2, and rps^2 is dominant to rps.

835. HARTWIG, E. E., and J. M. EPPS. 1970. An additional gene for resistance to the soybean cyst nematode, *Heterodera glycines.* Phytopathology 60:584. (Abstr.)

The soybean cultivar Peking has been used as the source of resistance to the soybean-cyst nematode in developing cultivars Pickett, Dyer, and Scott. Resistance to Peking is conditioned by three independent recessive genes rhg_1, rhg_2, and rhg_3 and a dominant gene Rhg_4 which is closely linked with the Ii locus. The Ii locus controls seed coat color. A strain of the cyst nematode found in Virginia reproduces on Peking, but P.I. 90763 gives complete resistance. Genetic studies show that P.I. 90763 carried an additional recessive gene for resistance.

836. HARTWIG, E. E., and J. M. EPPS. 1972. Breeding soybeans with resistance to nematodes. Soybean News 23(2):2, 6.

The problems involved in breeding soybeans with resistance to the root-knot and soybean-cyst nematodes are discussed.

837. HASKELLS, R. J., and G. H. MARTIN. 1919. Summary of plant diseases in United States in 1918. III. Diseases of field and vegetable crops. U.S. Dept. Agr. Bull. Suppl. 3, pp. 84–119. (Mimeo.)

838. HASKELL, R. J., and J. I. WOOD. 1923. Diseases of cereal and forage crops in the United States in 1922. Plant Dis. Reptr. Suppl. 27:164–265.

Records the first occurrence of *Peronospora* sp. on soybean in the United States.

839. HASKELL, R. J. 1926. Diseases of cereal and forage crops in the United States in 1925. Plant Dis. Reptr. Suppl. 48:301–381.

Includes records on the prevalence of *Bacterium glycineum* (= *Pseudomonas glycinea*), *Bacterium* (= *Xanthomonas*) *phaseoli* var. *sojense, Cercospora* sp., *Peronospora sojae* (= *P. manshurica*), *Sclerotium rolfsii, Septoria glycines,* mosaic virus, and root rot of undetermined cause.

840. HATTINGH, I. D. 1954. Control of witchweed. Farming South Africa 29:316–318.

A popular article. Soybean roots secrete the substances capable of germinating witchweed seed *Striga lutea* Lour, but are themselves not attacked by the parasite.

841. HEAGLE, A. S., D. E. BODY, and G. E. NEELY. 1974. Injury and yield responses of soybean to chronic doses of ozone and sulfur dioxide in the field. Phytopathology 64:132–136.

Beginning 14 days after emergence, Dare soybean plants were covered by chambers and exposed for 6 hr./day to O_3, SO_2, and a mixture of these gases. The chamber treatments were carbon-filtered air (CF), 5 pphm O_3 (low O_3), 10 pphm O_3 (high O_3), 10 pphm SO_2 (SO_2), and 10 pphm O_3 + 10 pphm SO_2 (mix). Plants were also grown outside in ambient air (AA). Injury, growth, and yield of plants were evaluated 43, 92, and 133 days after exposure began. Sulfur dioxide alone or in the mix did not significantly affect these responses. Low O_3 caused injury and defoliation but did not significantly reduce growth or yield. High O_3 and the mix caused injury and defoliation and reduced growth and yield. Injury was usually somewhat greater, and yield somewhat less, in the mix than in the high O_3, but these differences were not statistically significant. The results show that soybean can sustain some ozone injury without loss of yield and suggest that, unless acute episodes cause extensive foliar injury, soybean yield will not be reduced in areas with seasonal daily 6-hr. averages of less than 5 pphm O_3 or 10 pphm SO_2.

842. HEALD, F. D. 1906. Report on the plant diseases prevalent in Nebraska during the season of 1905. Nebraska Agr. Expt. Sta. Ann. Rpt. 19, pp. 20–81.

In bacterial blight caused by *Bacillus* sp., the leaves become covered with small brown spots or pustules. The spots increase in size and numbers, often become contiguous and often are surrounded by a narrow margin of yellow. Finally all the intervening tissue becomes discolored and the leaf dies. Often large irregular patches of the dead tissue fall away, leaving perforations or irregular margins. Generally the leaf tip is the first part affected. The disease was not observed till early October, so cultural studies have not yet been made.

843. HEALD, F. D. 1906. New and little-known plant diseases in Nebraska. Science (n.s.) 23:624.

One of the first reports of the occurrence of bacterial blight.

844. HEATH, R. G. 1958. Annual report of the department of agriculture, Federation of Malaya, for the year 1957.

Soybean mosaic virus is reported, a new record for Malaya.

845. HEDGES, F. 1922. Bacterial pustule of soybean. Science (n.s.) 56:111–112.

A leaf spot of soybean which differs from bacterial blight in the earlier stage of attack was found in Washington, D.C. The disease is named as pustule of soybean. Infection causes hypertrophy and hyperplasia of infected tissues. The organism, *Bacterium phaseoli* var. *sojense* n.var. (= *Xanthomonas phaseoli* var. *sojense*) (without description), resembles *B. phaseoli* (= *X. phaseoli*) but differs slightly in growth characters.

846. HEDGES, F. 1924. Soybean pustule. Comparative studies with *Bacterium phaseoli* var. *sojense* Hedges and *Bacterium phaseoli* E.F.S. Phytopathology 14:27–28. (Abstr.)

An abstract of entry 847.

847. HEDGES, F. 1924. A study of bacterial pustule of soybean, and comparison of *Bacterium phaseoli sojense* Hedges with *Bacterium phaseoli* E.F.S. J. Agr. Res. 29: 229–251.

A detailed account of the history and symptoms of bacerial pustule and varietal susceptibility to it. The pustules are caused by both hypertrophy and hyperplasia chiefly of parenchyma. On *Phaseolus, Bacterium* (= *Xanthomonas*) *phaseoli sojense* does not form pustules and is less infectious than *B.* (= *X.*) *phaseoli.* To soybeans, *B.* (= *X.*) *phaseoli* is very weakly pathogenic. Excepting colonies on beef agar plates, the two organisms behave alike on all cultural media tested. Morphological characters of both bacteria are described. Passage of *X. phaseoli* var. *sojense* through *Phaseolus* sp. increases its virulence towards this host.

848. HEDGES, F. 1926. Bacterial wilt of beans (*Bacterium flaccumfaciens*), including comparisons with *Bacterium phaseoli.* Phytopathology 16:1–22.

Bacterium flaccumfaciens (= *Corynebacterium flaccumfaciens*) infected soybeans by artificial inoculation.

849. HEDJAROUDE, G. A., and N. ALE-AGHA. 1971. Downy mildew of soybean [in Farsi, English summary]. Iran J. Plant Path. 7:33–38.

Peronospora manshurica is newly recorded on soybean in Iran. The study covers symptoms, morphology of the fungus, and methods of control.

850. HEGGE, A. H. 1957. Soybean cyst nematode in Missouri. Plant Dis. Reptr. 41:201.

Examination of soil samples reveals the presence of the soybean-cyst nematode (*Heterodera glycines*) in eight fields in southeastern Missouri.

851. HEINZE, K., and E. KOHLER. 1940. Die mosaikkrankheit der sojabohne und ihre ubertragung durch insekten [in German]. Phytopath. Z. 13:207–242.

A mosaic disease of soybean identical or closely related to that described in North America was found in Germany. The virus is transmitted by seeds, sap, and insects *Doralis frangulae, D. rhamni, D. fabae, Macrosiphum solanifolii, Myzus ornatus, Neomyzus circumflexus, Anlacorthum pseudosolani,* and *Myzodes persicae.* The virus in sap is inactivated at a temperature of 61 C, and remains viable 3–4 days at 21–33 C. The virus is transmissible to beans and vetches. Methods of control are suggested.

852. HEINZE, K. 1941. [Feldinfektionsversuch mit dem sojabohnenvirus.] Mitt. Biol. Reichsanst. f. Land u. Forstw. 65:23.

The Giessen and Dieckmann 1940 selections of soybean are resistant to mosaic.

853. HEINZE, K. 1942. Field sanitation in soybean plantings as a prophylactic measure against the spread of the soybean mosaic virus. Preliminary note [in German]. Vorl. Mitt. Zuchter 14:254–258.

The most destructive disease of soybean, especially of yellow varieties, in Germany is mosaic, which necessitates stringent field sanitation to prevent perpetuation of the virus by the seed of infected plants. This mode of control involves repeated inspections in field. The first count 4–5 weeks after planting revealed incidence of 23% diseased plants, which rose sharply in summer owing to prevalence of aphids. There were marked differences between plots from which infected plants had been eliminated and nontreated plots.

854. HEMMI, T. 1915. On a new brown spot disease of soybean [in Japanese]. Bull. Hokkaido Agr. Assoc. 5(4):1–4.

A condensed report of entry 855.

855. HEMMI, T. 1915. A new brown spot disease of the leaf of *Glycine hispida* Maxim. caused by *Septoria glycines* sp.n. Trans. Sapporo Nat. Hist. Soc. 6:12–17.

Describes symptoms of the disease and morphology of the causal fungus. The differences between *Septoria glycines* and *S. sojina* are tabulated.

856. HEMMI, T. 1920. Beiträge zur kenntnis der morphologie und physiologie der Japanischen Gloeosporien [in German]. J. Coll. Agr. Hokkaido Imp. Univ. 9:1–159.

Describes the morphology of *Colletotrichum glycines* (= *C. dematium* f. *truncata*) and *Gloeosporium* sp. on soybean pods.

857. HEMMI, T. 1921. Nachtrage zur kenntnis der Gloeosporien [in German]. J. Coll. Agr. Hokkaido Imp. Univ. 9:305–346.

Cultural studies on the influence of H_2SO_4, H_3BO_3, Na-

OH, and different concentrations of sugar and peptone on growth of *Gloeosporium* sp. and *Colletotrichum glycines* (= *C. dematium* f. *truncata*).

858. HEMMI, T. 1940. Studies on septorioses of plants. VI. *Septoria glycines* Hemmi causing the brown spot disease of soybean. Mem. Coll. Agr. Kyoto Imp. Univ. 47:1–14.

Brown spot disease of soybeans (*Septoria glycines*) is stated to be very prevalent on leaves of plants cultivated along the raised footpaths between the rice fields near Kyoto, Japan, though less destructive in the locality under observation than in the north of the country. First symptoms of infection in the early summer are brown or pale reddish-brown, slightly raised, angular, sharply defined spots, gradually turning dark to blackish brown, on both leaf surfaces. The diseased foliage is prematurely shed from the base upwards.

The fungus readily produced pycnidia and pycnospores on potato-decoction agar plus sucrose. The globose or subglobose, thin-walled, brown, ostiolate pycnidia measure 44–125 μ in diameter, and the filiform, hyaline, mostly irregularly curved, rarely guttulate, uni- to quadricellular spores 16.6–52.5 $\times$ 1.3–2.1 μ on the leaves and 22.4–48 $\times$ 1.3–2.1 μ in culture. The pycnospores germinate by means of one or two germ tubes in 24–50 hr. in water or on a nutrient medium, the swollen cells sometimes separating and developing within 48 hr. into secondary conidia. The minimum, optimum, and maximum temperatures for growth of the fungus on various standard media were found to be 5, 24–28, and 36 C, respectively. Pycnospore formation was not affected by light or darkness, but tended to proceed more rapidly under the influence of fluctuating temperatures. Inoculation experiments with spore suspensions of *S. glycines* from agar cultures on leaves of young soybean plants maintained at 24–25 C for 24 hr. in moist chambers and then transferred to a greenhouse gave positive results after incubation 10–14 days. The fungus was further shown to be capable of inducing fresh outbreaks of leaf spot by means of seed- and soil-borne infection.

859. HENDERSON, V. E., and H. KATZNELSON. 1961. The effect of plant roots on the nematode population of soil. Canad. J. Microbiol. 7:163–167.

Pratylenchus, Paratylenchus, and *Aphelenchus avenae* and the total number of nematodes was greatest in the rhizosphere of soybean roots. Low light intensity resulted in increased number of nematodes in rhizosphere.

860. HENDRICKS, F. L. 1939. [Phytopathological observations at stations of Mulungu in 1938.] *In* Rapport annuel pour l'exercice 1938 (2ième partie). Pub. Inst. Natl. Étud. Agron. Congo Belge, pp. 117–128.

Records the occurrence of *Ascochyta sojaecola* and *Uromyces sojae* (= *Phakopsora pachyrhizi*) on soybean in Belgian Congo.

861. HENDRIX, F. F., and L. W. NIELSEN. 1958. Invasion and infection of crops other than the forma suscept by *Fusarium oxysporum* f. *batatas* and other formae. Phytopathology 48:224–228.

Vascular browning of soybeans occurred when planted in sand infested with or inoculated with *Fusarium oxysporum* f. *batatas* from sweet potato.

862. HENNINGS, P. 1903. Some new Japanese Uredinales IV [in German]. Hedwigia Suppl. 42:107–108.

Uredo sojae (= *Phakopsora pachyrhizi*) collected on leaves in the province of Tosca, September 1902, and described as a new species with Latin description.

863. HERR, L. J. 1957. Factors affecting a root rot of soybean incited by *Phytophthora cactorum*. Phytopathology 47:15. (Abstr.)

Young plants 1–3 weeks old were more susceptible than were older plants. The rate at which plants were killed decreased progressively in older groups of plants. Disease incidence decreased with decreasing concentrations of inoculum. Method of adding inoculum to the soil and location of the inoculum with respect to the plant greatly influenced disease development. Pathogen-free filtrates of culture solutions were not toxic to soybeans.

864. HERR, L. J. 1957. Nutritional studies of an isolate of *Phytophthora cactorum* inciting a root rot of soybeans in Ohio. Phytopathology 47:16. (Abstr.)

This fungus, like most species of *Phytophthora,* required thiamine for growth. Nitrogen requirements of the fungus differed, depending on whether sucrose or cellulose was used as the carbon source. When sucrose was used, the best chemically defined sources of N were KNO_3 and L-asparagine. There was no significant difference in growth of the fungus on sucrose when supplied with these two N sources. With purified cellulose as the C source, growth occurred only when organic N compounds (amino acids and amides), L-asparagine and L-aspartic acid supported the best growth of the fungus.

865. HEUBERGER, J. W., and T. F. MANNS. 1943. Effect of organic and inorganic seed treatments on rate of emergence, stand, and yield of soybeans. Phytopathology 33:1113. (Abstr.)

An abstract of entry 866.

866. HEUBERGER, J. W., and T. F. MANNS. 1944. Effect of organic and inorganic seed treatments on rate of emergence, stand, and yield of soybeans. Delaware Agr. Expt. Sta. Pamp. 11. (Mimeo.)

Arasan, spergon, ceresan, and dow no. 5 accelerated emergence of seedlings and increased stand, arasan being the only material that increased the yield significantly.

867. HEUBERGER, J. W. 1945. Department of plant

pathology. *In* Delaware Agr. Expt. Sta. Rpt. 1944–45, pp. 33–39. Delaware Agr. Expt. Sta. Bull. 259.

Dithane applied as a soil disinfectant at 100 lb./acre at planting time severely damaged the soybean seeds. Spergon is considered best for seed treatment of soybean.

868. HILDEBRAND, A. A. 1942. Diseases of soybeans, their control. Canad. Hort. and Home Mag. 69:129–131, 142.

A popular account on the control of soybean diseases by seed treatment, cultural practices, and other precautions.

869. HILDEBRAND, A. A. 1944. *In* Symposium of seed-borne diseases. Proc. Canad. Phytopath. Soc. 12: 18–21.

Soybeans are susceptible to at least 32 parasitic diseases, and 11 of a reported total of 13 seedborne diseases occur in Canada. *Diaporthe phaseolorum* var. *sojae* pod and stem blight, *Glomerella glycines* anthracnose, and soybean mosaic were not amenable to control by surface disinfectants, but seed treatment of *Peronospora manshurica* infected seeds can be highly effective. Treatment of such seeds with spergon or arasan not only increased emergence but reduced postemergence disease in seedlings. In general, spergon was more effective than arasan or fermate.

870. HILDEBRAND, A. A., and L. W. KOCH. 1945. Some studies on *Macrophomina phaseoli* (Maubl.) Ashby in Ontario. Sci. Agr. 25:690–706.

Plants were prematurely killed. Two isolates of *Macrophomina phaseoli* (= *M. phaseolina*), i.e. Ontario strain and Texas strain, compared morphologically and pathogenically. Ontario strain infected plants when they approached senescence. Pycnidia and sclerotia were formed. When plants were grown at soil temperatures 11–33 C, infection appeared much earlier at 27 and 33 C. Morphology of pycnidia and conidia is described. The two strains can be distinguished on the basis of differences in size and number of sclerotia produced in culture.

871. HILDEBRAND, A. A., and L. W. KOCH. 1946. Seed treatment and other tests with soybean in Ontario. Phytopathology 36:401. (Abstr.)

An abstract of entry 872.

872. HILDEBRAND, A. A., and L. W. KOCH. 1947. Soybean diseases in Ontario and effectiveness of seed treatment. Phytopathology 37:111–124.

Of the 13 parasitic diseases known to occur in Canada, 8 or possibly 9 are seedborne. In a 3-year experiment of seed treatment with spergon, arasan, and fermate, increase in emergence and yield was obtained only with poor-quality, weather-damaged or cracked seeds treated with spergon. In no other cases were the increases in early stands correlated with significant gains in yield. Varietal differences were noticed in susceptibility to *Septoria glycines,* with Harman and A. K. Harrow being most resistant.

873. HILDEBRAND, A. A., and L. W. KOCH. 1947. Observations on bud blight of soybeans in Ontario. Sci. Agr. 27:314–321.

Bud blight, a potentially dangerous disease of soybeans caused by the tobacco ring spot virus, is prevalent throughout the more important soybean growing areas of southwestern Ontario. Symptoms consist of a characteristic distortion, brittleness, and necrosis of the shoot tip; yellowish discoloration, more or less rugosity, cupping or rolling, sometimes veinclearing, and necrotic stippling of young and bronzing of older leaves; blighting of buds and blossoms; marked reduction in number and size of pods; frequent discoloration and malformation of seeds; characteristic reddish-brown discoloration of the pith, at first nodal, later internodal as well. Early-season infection arrests the growth of plants while late-season infection causes them to remain green until late in the fall. In two years' experiments, 0.52% of 2,489 plants grown from seed obtained from bud blight-infected plants developed symptoms of the disease while among 38,994 plants grown either from general-run seed or from seed from bud blight-free plants, 0.15% showed bud blight infection. The percentages are so low, and the first is so slightly in excess of the latter, that evidence as to the seedborne nature of the disease is of doubtful significance.

874. HILDEBRAND, A. A. 1948. An occurrence of brown stem rot of soybeans in Ontario. Sci. Agr. 28: 261–263.

The fungus is soilborne and infection takes place either through the roots or at the base of the stem near ground level. Incidence of the disease depends upon low air temperature. Affected plants, when split open, show browning and necrosis of pith and xylem starting at or just below the soil line. Leaves at the tip may show interveinal chlorosis followed by necrosis and finally scrotched appearance. The causal fungus is a species of *Cephalosporium.*

875. HILDEBRAND, A. A. 1948. Keeping abreast with soybean diseases in Ontario. Soybean Dig. 8(10):16–17.

A popular article. Since 1942, 14 diseases have been found and at least 8–9 are seedborne. Mosaic in 1942 was in epidemic form. *Sclerotinia* (= *Whetzelinia*) *sclerotiorum* had destroyed 3–4 acres in a 12-acre planting. Recommendations for control and seed treatment are presented.

876. HILDEBRAND, A. A., and L. W. KOCH. 1950. Observations on six years' seed treatment of soybeans in Ontario. Sci. Agr. 30:112–118.

Soybean seed of cultivar A. K. Harrow, varying from year to year both as to germinability and disease poten-

tiality, was treated with spergon, arasan, fermate, phygon, phygon-XL, and F-800 and planted in outdoor plots in a randomized, 5-replicate design. In the extremely poor-quality 1943 seed (germinating capacity 23.4% and visibly diseased to the extent of 40%), treatment with spergon increased emergence and yield. This was the only instance, however, in which an increase in early stand of plants, as the result of seed treatment, was correlated with a statistically significant increase in yield. More noteworthy than the effect of seed treatment in modifying yield was that of favorable weather. A remarkable increase of some 10 bu./acre in 1948 over all other years apparently was correlated more closely with adequate, well-distributed rainfall than with any other factor.

877. HILDEBRAND, A. A., and L. W. KOCH. 1951. A study of systemic infection by downy mildew of soybean with special reference to symptomatology, economic significance and control. Sci. Agr. 31:505–518.

Soybean plants exhibited systemic and local infection. Systemic infection originates from infected seeds. The mycelium and oospores of *Peronospora manshurica* are borne on or within the seed coat. Growth of the fungus within the plant, though not immediately concurrent with that of the plant, finally invades all parts of the plant. Systemically infected plants produce abundant conidia which become windborne and initiate local infection in new areas. Some systemically infected plants die prematurely, others exhibit spindly growth and produce few seeds, while still others, though they exhibit foliar symptoms, grow vigorously and produce normal yield, but most of the seeds are infected. Oospore-encrusted seeds, when treated with spergon or fermate, increased in emergence and the plants virtually were free of systemic infection. There was a significant increase in yield.

878. HILDEBRAND, A. A., and L. W. KOCH. 1952. Observations on a root and stem rot of soybeans new to Ontario, caused by *Pythium ultimum* Trow. Sci. Agr. 32:574–580.

This is the first report of *Pythium ultimum* as being pathogenic to soybeans. It was found in early July 1951 affecting a number of cultivars. Affected plants were dwarfed, showing first a wilting, then necrotic, brown dried-out conditions. The disease is favored by low soil temperature, although in heavily infested soils the fungus is capable of destroying seed over a wide range of soil temperatures.

879. HILDEBRAND, A. A. 1952. Stem canker; a disease of increasing importance on soybeans in Ontario. Soybean Dig. 12(9):12–15.

A popular article. Stem canker as now distinguished from pod and stem blight is currently the most serious disease of soybeans in Ontario. Prior to 1949 the disease was sporadic in occurrence and only rarely serious. With the introduction and widespread planting of cultivars Hawkeye in 1949 and Blackhawk in 1951, the disease has flared into importance. Evidence suggests that the causal fungus is residual in the soil of the province and may not have been introduced to any appreciable extent with the seed. Cultivars differ considerably in susceptibility, Harman being apparently the least susceptible of 11 cultivars closely observed in 1951. Crop rotation and avoidance of planting the most susceptible cultivars are suggested as means of modifying prevalence and severity of the disease.

880. HILDEBRAND, A. A. 1952. Observations on spread in soil of *Cephalosporium gregatum,* Allington, and Chamberlain, the cause of brown stem rot of soybean. Plant Dis. Reptr. 36:106–107.

Brown stem rot is a potential threat to soybean in Ontario. Healthy soils easily become contaminated by causal organism which rapidly spreads through the soil. Crop rotation is necessary for control.

881. HILDEBRAND, A. A. 1953. Diseases of soybean in southwestern Ontario in 1952. Canad. Sci. Serv. Div. Bot. and Plant Path., Ann. Rpt. 32, pp. 35–37.

882. HILDEBRAND, A. A. 1953. Studies on stem canker and pod and stem blight of soybeans in Ontario caused by *Diaporthe* species. Proc. Canad. Phytopath. Soc. 20:16. (Abstr.)

An abstract of entries 885 and 887.

883. HILDEBRAND, A. A. 1953. An elaboration of the toothpick method of inoculating plants. Canad. J. Agr. Sci. 33:506–507.

Quill-type wooden toothpicks are boiled and rinsed in three changes of tap water. Tips of suitable length are placed, sharpened end up, in small glass vials; potato-dextrose broth is added until the tips are just covered; the vials are plugged, autoclaved, and inoculated in the usual manner and autoclaved for the requisite period of time. Retained in a ring around the inside wall of a suitable container by means of a cardboard "collar," the vials can be group-labeled and handled conveniently through all manipulations. In inoculating, mycelium-enveloped tips are inserted into awl-punctures in the stem or other parts, the protruding ends are cut off, and the wound is sealed with vaseline.

884. HILDEBRAND, A. A. 1953. Some aspects of soybean diseases in Ontario. Soybean Dig. 13(9):18–20.

A popular article describing general environmental conditions and cultural practices favoring disease development and losses caused by diseases of soybean in Ontario.

885. HILDEBRAND, A. A. 1954. Observations on the occurrence of the stem canker and pod and stem blight

fungi on mature stems of soybean. Plant Dis. Reptr. 38: 640–646.

Mature stems of soybeans collected in autumn 1953 and subsequently left to stand for 3–4 weeks in shallow water in a humid atmosphere were examined critically for occurrence of *Phomopsis* and *Diaporthe* spp. Pycnidia of the *Phomopsis* type, which varied widely in their morphology, occurred on a large proportion of the 1,046 stems examined. Despite various manipulations of pycnidium-bearing stems and the pairing of 20 monoconidium isolates, no evidence of a sexual reaction was observed. Perithecia occurred on 123 (11.7%) of the stems and 3 stems were unique in having produced pycnidia similar in appearance to perithecia of *Diaporthe*. Monoascospore cultures obtained from 5 stems, 2 of which showed only a single perithecium each, and 3 of which had long-beaked perithecia intermixed with pycnidia, gave rise to *Phomopsis* isolates which are regarded as being representatives of the imperfect stage of the pod and stem blight organism, *D. phaseolorum* var. *sojae*, to be heterothallic. Monoascospore cultures derived from 20 stems which showed either the cespitose or a seemingly more dispersed type of perithecial development, gave rise to isolates of the stem canker organism, *D. phaseolorum* var. *batatatis*, which has been shown to be homothallic and produces its perithecia in cespitose groups. In addition to the ascus stage, certain of the isolates revealed the presence of conidia similar to the alpha spores of *Phomopsis*. These conidia were produced sparsely, presumably on the mycelium. Other isolates produced, in addition to the ascus stage, rare ectostromatic bodies containing locules from which typical *Phomopsis* spores of the alpha type were exuded. Such evidence of an imperfect stage of *D. phaseolorum* var. *batatatis* as a pathogen of the soybean has not been reported heretofore.

886. HILDEBRAND, A. A., and H. R. BOYCE. 1955. An occurrence of mealybugs and of *Botrytis* on soybean in Ontario. Plant Dis Reptr. 39:171–173.

In August 1954 a species of mealybug, *Pseudococcus maritimus*, was found on the roots of soybeans growing in outdoor experimental plots at Harrow Laboratory. Circumstantial evidence suggested infested roots of red clover growing adjacent to the soybeans as the probable source of the insects, and ants as the agents of transport from the red clover to the soybeans. Contemporaneously, a representative of *Botrytis* was found infecting the basal stem region of many soybean plants. Although neither insect nor fungus was causing any readily discernible injury to soybeans, each was being investigated further — the former as a possible vector of the bud blight disease of soybeans caused by a virus of the tobacco ring spot group, the latter in its possible causal relationship to an apparently new disease that has commanded attention in Ontario this year.

887. HILDEBRAND, A. A. 1956. Observations on stem canker and pod and stem blight of soybeans in Ontario. Canad. J. Bot. 34:577–599.

Stem canker caused by *Diaporthe phaseolorum* var. *caulivora* is a serious disease of soybeans in Ontario. Artificial inoculation experiments have indicated (a) that soybeans which are highly susceptible to infection at midstage in their development become progressively less so as they approach maturity, (b) that reduction in yield is more or less directly proportionate to earliness of infection, (c) that all cultivars presently of commercial importance in Ontario are highly susceptible to the disease, and (d) that 6 common weeds and tomato, pepper, and snap and field beans, are not susceptible to infection by the soybean pathogen. Tests also indicated that monoconidial isolates of the stem canker organism are as highly pathogenic as those derived from single ascospores, and that isolates, though morphologically similar, may be differentiated on the basis of their pathogenic capability. The pathogen is definitely seedborne but infection from such a source is not of primary importance. The likelihood that the pathogen is indigenous to soil of the soybean-growing area of Ontario is discussed. Pod and stem blight caused by *Diaporthe phaseolorum* var. *sojae* is of negligible economic importance in Ontario. The pathogen, which is observed mostly in the imperfect (*Phomopsis*) stage, shows little evidence of being able to infect plants until late in the growing season. In the absence of resistant cultivars no better control methods can be recommended than those of completely plowing under soybean debris, of avoiding planting the more susceptible cultivars, and of practicing crop rotation.

888. HILDEBRAND, A. A. 1957. A Phytophthora root and stalk rot of soybeans. Proc. Canad. Phytopath. Soc. 25:14–15. (Abstr.)

Cause of root and stalk rot is tentatively identified as *Phytophthora megasperma*. Outbreak coincided with widespread planting of the highly susceptible Harosoy cultivar. Other cultivars, including Monroe, remained unaffected. The fungus grows at temperatures of 7.5–32.5 C (optimum 25 C). In experimental inoculations certain varieties of snap beans and dry beans (*Phaseolus vulgaris*) and lima beans (*P. lunatus*) are susceptible.

889. HILDEBRAND, A. A. 1959. A root and stalk rot of soybeans caused by *Phytophthora megasperma* Drechsler var. *sojae* var. nov. Canad. J. Bot. 37:927–957.

Since 1954 a destructive root and stalk rot of soybeans, identical with one reported from several soybean-growing areas in the United States, has been prevalent in southwestern Ontario. It is proposed that *Phytophthora megasperma* var. *sojae* nov. var. replace *P. cactorum*, and *P. sojae*, as the more correct taxonomic designation of the causal fungus. *P. megasperma* var. *sojae* comprises strains which, though indistinguishable morphologically, differ physiologically and pathologically. Artificial inoculation of cultivars, breeding lines, and selections of soybeans

with the causal fungus, chiefly by the highly reliable toothpick method, indicated two well-defined types of disease reaction, resistance, and susceptibility. Harosoy, the cultivar currently grown most extensively in Ontario, is highly susceptible to the disease. Pathogenicity trials involving many possible wild and cultivated hosts emphasized the marked specificity of *P. megasperma* var. *sojae* to soybean. The soybean *Phytophthora,* having been called *P. cactorum* and thereby associated nomenclaturally with a representative of that species causing a root rot of sweet clover in Ontario, was found to be quite different from the sweet clover pathogen.

890. HILDEBRAND, A. A. 1960. Root and stalk rot of soybeans in southwestern Ontario. Forage Notes (Ottawa) 6(2):7–10.

891. HILL, J. H., A. H. EPSTEIN, M. R. MC LAUGHLIN, and R. F. NYVALL. 1973. Aerial detection of tobacco ring spot virus infected soybean plants. Plant Dis. Reptr. 57:471–472.

892. HILTY, J. W., and A. F. SCHMITTHENNER. 1962. Pathogenic and cultural variability of single zoospore isolates of *Phytophthora megasperma* var. *sojae.* Phytopathology 52:859–862.

Variation in pathogenicity of 94 single zoospore isolates of *Phytophthora megasperma* var. *sojae* obtained from nine mass culture sources was investigated using two resistant and two susceptible cultivars of soybeans. One isolate was nonpathogenic on all test cultivars; another was slightly virulent on resistant cultivars. Other differences in virulence on susceptible cultivars were noted. When virulence of representative isolates from each mass culture was compared, isolates varied with respect to source. Isolates representing virulence extremes were selected from each source and incubated 5 days on two media at two concentrations at three temperatures for studying cultural variability. There was significant variation in amount of growth at different temperature-medium-concentration combinations. Amount of growth and virulence varied independently.

893. HILTY, J. W., and A. F. SCHMITTHENNER. 1966. Electrophoretic comparisons of soybean leaf protein from varieties resistant and susceptible to *Phytophthora megasperma* var. *sojae.* Phytopathology 56:287–291.

Soybean proteins were best extracted by grinding fresh leaf tissue in a mortar in H_2O, 1 M urea, or 0.5% sodium desoxycholate. The greatest number of protein zones was obtained when the extracts were concentrated osmotically and separated electrophoretically on acrylamide gels. The number of zones varied from 16 to 22, depending upon the extraction and concentration procedures employed. Extracts made with 0.5% sodium desoxycholate at pH 7.2 and concentrated in a 25% aqueous solution of sucrose separated into the largest number, the most distinct, and the most densely stained protein zones. Protein zones of extracts from healthy soybean Harosoy and Harosoy 63 were the same with all extraction-concentration combinations used.

894. HINE, R. B., and J. E. WHEELER. 1970. The occurrence of some previously unreported diseases in Arizona. Plant Dis. Reptr. 54:179–180.

Sclerotinia (= *Whetzelinia*) *sclerotiorum* on soybean recorded for the first time in Arizona.

895. HINO, I. 1933. List of plants susceptible to mosaic and mosaic-like diseases. Miyazaki Coll. Agr. and For. Bull. 5, pp. 97–111.

Soybean mosaic is common in Miyazaki, Japan.

896. HINSON, K., and E. E. HARTWIG. 1964. Bragg and Hardee soybeans. Crop Sci. 4:664.

Both cultivars are resistant to *Xanthomonas phaseoli* var. *sojense, Pseudomonas tabaci,* and *Corynespora cassicola,* with a high degree of resistance to *Meloidogyne incognita.* Hardee is also resistant to *Cercospora sojina* leaf spot.

897. HIRAI, T. 1956. The diagnosis of plant virus diseases by means of the paper electrophoresis [in Japanese, English summary]. Kyoto Univ. Inst. Plant Dis., Forsch. auf dem Geb. der Pflanzenkrank. 6:87–96.

Seven viruses, including soybean mosaic, from six plant species were used in an experiment to compare the electrophoretic run between healthy and virus-infected plants. Conclusions: (1) virus-infected proteins move less than healthy proteins on a filter paper; (2) frequently the healthy proteins move toward the cathode, although the virus-infected proteins move toward the anode; (3) electrophoretic patterns of virus-infected proteins differ from those of healthy proteins.

898. HIRATA, K. 1955. Comparison of powdery mildews and their host plants of Japan and the United States of America [in Japanese, English summary]. Niigata Univ. (Japan) Fac. Agr. Bull. 30(5), pp. 146–152.

Erysiphe polygoni does not occur on soybean in Japan but does in the United States.

899. HIRATA, K. 1956. The powdery mildews parasitic on Leguminosae [in Japanese, English summary]. Niigata Univ. (Japan) Fac. Agr. Bull. 1956(8), pp. 110–122.

Two *Erysiphe* species, one *Microsphaera,* and one *Sphaerotheca* have been reported on one or three species of *Glycine* (specific names not designated). In a review of the literature (18 citations) it was found that 406 out of 12,000 species and varieties of Leguminosae are hosts of powdery mildews. This proportion (about 3.3%) is low when compared with the number of host plants in other families.

900. HIRATSUKA, N. 1932. Notes on soybean rust [in Japanese]. Trans. Biol. Soc. Tottori 1:8–11.

The name *Phakopsora pachyrhizi* is adopted for the soybean rust fungus, with *P. vignae* and *P. sojae* as its synonyms.

901. HIRATSUKA, N., and Y. HASHIOKA. 1933. Uredinales in Formosa I. Trans. Tottori Soc. Agr. Sci. 4:156–165.

Includes *Phakopsora pachyrhizi* on soybean.

902. HIRATSUKA, N., and T. YOSHINAGA. 1935. Uredinales of Shikoku (Japan). (Contributions to the rust-flora of Eastern Asia — II.) Tottori (Japan) Agr. Coll. Mem. 3:249–377.

Phakopsora pachyrhizi was collected on *Glycine soja* in Tosa and Iyo provinces, and on *Glycine ussuriensis* in Tosa province.

903. HIRATSUKA, N. 1935. Uredinales collected in Korea I. Bot. Mag. (Tokyo) 49:145–152.

Phakopsora pachyrhizi from soybean was also collected.

904. HIRATSUKA, N. 1935. *Phakopsora* of Japan I. Bot. Mag. (Tokyo) 49:781–788.

Includes *Phakopsora pachyrhizi* on soybean with a discussion of its synonyms. The pathogen is widely distributed in Japan.

905. HIRATSUKA, N. 1936. Uredinales collected in Kushu (Japan). III. J. Japan. Bot. 12:265–272.

Collection of *Phakopsora pachyrhizi* on soybean and of *Glycine ussuriensis* in the province of Chikugo, 1935.

906. HIRATSUKA, N. 1941. Materials for rust-flora of Manchoukuo, I. Trans. Sapporo Nat. Hist. Soc. 16:193–208.

Collection of *Phakopsora pachyrhizi* in the province of Kitsurin (Manchuria), September 1943.

907. HIRATSUKA, N., and S. SATO. 1953. A contribution to the knowledge of the rust-flora of Mt. Fuji and its vicinities, Fuji-Hakone National Park [in Japanese]. Nagaoa 3:57–100.

Phakopsora pachyrhizi collected on cultivar Davidzu. Stages of rust are cited as II, III.

908. HIRSCHMANN, H. 1956. A morphological comparison of two cyst nematodes, *Heterodera glycines,* and *H. trifolii.* Phytopathology 46:15. (Abstr.)

An abstract of entry 909.

909. HIRSCHMANN, H. 1956. Comparative morphological studies on the soybean-cyst nematode *Heterodera glycines* and the clover-cyst nematode *H. trifolii* (Nematoda:Heteroderidae). Proc. Helminth. Soc. Washington 23:140–151.

A detailed comparison of cysts, eggs, and second-stage larvae of the soybean-cyst nematode, *Heterodera glycines,* and the clover-cyst nematode, *H. trifolii,* was made. No differences were found in characters of the lemon-shaped cysts. In both species the young females are coated with a subcrystalline layer, and pass through a yellow color phase, when changing from white to brown. The cysts are dark brown in color and have brown knobs around the vulval aperture. There is no detectable difference in shape and size of the gelatinous egg sac, or in the number of eggs extruded into it. Length/breadth measurements were taken on 100 cysts of each species. The length/breadth ratio and the regression coefficients for length/breadth and breadth/length show no significant differences. Size of the transparent lip tops of the vulva cone, length of the vulva split, and distance from vulva to anus differ only slightly. The cyst wall exhibits the same pattern of zig-zag lines in the two species.

Length/breadth measurements of 300 eggs in each species showed no dissimilarity in size, shape, or length/breadth ratio of the eggs. Consistent morphological differences were found in the second-stage larvae of the two species. Characters that differ considerably are body length, shape, and size of the stylet, distance of the dorsal gland orifice behind the stylet knobs, shape and length of the tail, as well as length of the tail terminal. Measurements of these characters were taken on 5 larvae from each of 30 cysts in each species. There was no overlapping in the means of the various characters.

910. HIRSCHMANN, H. 1959. Histological studies on the anterior region of *Heterodera glycines* and *Hoplolaimus tylenchiformis* (Nematoda:Tylenchida). Proc. Helminth. Soc. Washington 26:73–90.

The external cuticle of males of *Heterodera glycines* and adults of *Hoplolaimus tylenchiformis* has the same fundamental structure. In the mid-region of the body it consists of three distinct layers (a), (b), and (c) which are likely to correspond to the cortical, matrix, and fiber layers demonstrated in other nematodes. When both nematode species are treated with 5% NaOCl all layers of the cuticle except the outermost part of layer (a) are dissolved. This part also disintegrates when the specimens are pretreated with heat, suggesting that it constitutes a thermolabile membrane. The innermost layer (c) shows a transverse striation, two annules of which correspond to one body annule. This striation starts at the lip constriction and ends in the caudal region. It is absent where the chords proceed the length of the body. It is also missing where cephalids and hemizonid encircle the body. The cephalids are highly refractive structures, biconvex in longitudinal section, and extend around the nematode body in the cephalic region. They are a common feature in males and second-stage larvae of *Heterodera* species and have been detected also in adults of *Hoplolaimus tylenchiformis.* Their characteristic loca-

tion behind the lip constriction in *Heterodera* males and second-stage larvae may be of taxonomic value when used in conjunction with other characters. Closer examination revealed that the hypodermal chords begin where the cephalids encircle the body: The two lateral chords start at the anterior cephalid, the two median chords at the posterior cephalid. No evidence was obtained as to histological nature of the cephalids.

The hemizonid which is common in the order Tylenchida was found to be similar in structure to the cephalids. In longitudinal section it appears more or less biconvex, highly refractive, and characterized by absence of the striation of cuticular layer (c). The only difference from the cephalids is that it describes half a circle on the ventral side of the nematode body extending from lateral chord to lateral chord. Although their structures are well defined, the biological functions of the cephalids and hemizonid are not yet understood. It may be postulated that they either take part in some sensory perception or arise merely from the attachment of organs to the body wall. In addition to the investigations on cuticular layering, the lip region, somatic musculature, stylet musculature, and amphids of the anterior region of males of *H. glycines* are described.

911. HIRSCHMANN, H. 1960. External characters and body wall of nematodes. *In* Nematology, J. N. Sasser and W. R. Jenkins (eds.), pp. 130–135. Chapel Hill, N.C.

The external characters of many kinds of nematodes, including the soybean-cyst nematode, are given. Report also includes a study of the cuticle, hypodermis, and somatic musculature of nematodes.

912. HIRSCHMANN, H., and A. C. TRIANTAPHYLLOU. 1962. Oogenesis and reproduction in *Heterodera glycines* and *H. trifolii.* Phytopathology 52:13. (Abstr.)

Oögoneal divisions were observed in larvae of the fourth molt in both nematode species. In three populations of *Heterodera glycines,* maturation of oöcytes proceeded only in inseminated females and consisted of two divisions and formation of two polar bodies. There were 9 bivalent chromosomes at metaphase I. Sperm entered oöcytes at late prophase. Sperm and egg pronuclei fused to form the zygote nucleus. Six females, obtained from 200 larval inoculations of soybean seedlings, failed to produce embryonated eggs and showed marked retardation in growth. In one population of *H. trifolii,* maturation consisted of a single division, mitotic in type. There were 26 univalent chromosomes at metaphase. Reproduction took place in absence of males. Thus, *H. glycines* is a diploid and reproduces by cross fertilization, whereas the closely related *H. trifolii* appears to be a triploid and reproduces by parthenogenesis. Triploidy must have been established during evolution of the parthenogenetic mode of reproduction.

913. HO, H. H., and C. A. HICKMAN. 1967. Asexual reproduction and behavior of zoospores of *Phytophthora megasperma* var. *sojae.* Canad. J. Bot. 45:1963–1981.

A method was devised to produce abundant zoospores in distilled H_2O suspension from pure cultures of *Phytophthora megasperma* var. *sojae.* Sporangia were predominately nonpapillate, but occasionally inconspicuously or conspicuously papillate, germinating with formation of a delicate, evanescent vesicle. Proliferation of sporangia was observed. Flagella action of freely swimming zoospores was investigated photographically. Both flagella were proved to undulate. Zoospores remained motile longest at 15 C. Motility was markedly reduced at extreme temperatures (5 and 36 C), at extreme pH values (below 5.2 or above 9.25), or by mechanical disturbance, dilution, and frequent contact with solid surfaces. The fate of flagella during encystment was followed. Encysted zoospores germinated by germ tubes, or by secondary zoospores, or, in rare cases, the germ tube was terminated by a miniature sporangium. Repeated emergence of zoospores was favored at 15 C whereas total cyst germination and germ tube production were best at 25 C and in the presence of nutrients.

914. HO, H. H. 1969. Notes on the behavior of *Phytophthora megasperma* var. *sojae* in soil. Mycologia 61: 835–838.

It seems unlikely that zoospores of *Phytophthora megasperma* var. *sojae* might persist in soil in the form of germ tubes. In most cases, encysted zoospores failed to germinate in natural soil, presumably as a result of inhibition by other soil microorganisms, and for those that germinated, the germ tubes were soon lysed. Thus, it is most probable that *P. megasperma* var. *sojae* persists in soil within remains of diseased soybeans. Under favorable conditions the fungus might produce zoospores that can be carried far and wide by soil drenches and irrigation water. When zoospores are brought to the vicinity of plant roots their own intrinsic behavior towards roots provides them a better opportunity to infect the host. Their swimming capacity is a great advantage, particularly in light of the inability of germ tubes to initiate vegetative growth in natural soil.

915. HO, H. H. 1969. Effects of root substances on the growth and sporulation of *Phytophthora megasperma* var. *sojae.* J. Elisha Mitchell Sci. Soc. 85:97–100.

Root extracts of a highly resistant (Harosoy 63) and a highly susceptible (Harosoy) soybean cultivar and of a nonhost plant (Alaska pea) all stimulated the growth of *Phytophthora megasperma sojae* but suppressed sporangial formation. Effects were nonspecific as regards resistance and susceptibility, host and nonhost.

916. HO, H. H., and E. WEAVER. 1970. Peroxidase isozymes of soybean roots from varieties resistant and susceptible to *Phytophthora megasperma* var. *sojae.* Phyton Buenos Aires 27:163–167.

The peroxidase isozymes of roots from Harosoy and Harosoy 63 soybean cultivars, respectively susceptible and resistant to *Phytophthora megasperma* var. *sojae,* were studied by means of electrophoresis. Though peroxidase isozymes changed with age they were essentially similar in resistant and susceptible cultivars, particularly at early stages of development. Peroxidase isozymes in infected tissues cannot be correlated with disease resistance.

917. HO, H. H. 1970(1971). A study on the growth and sporulation of *Phytophthora megasperma* var. *sojae.* Sydowia 24:51–58.

The effects of temperature and pH on linear growth and mycelial dry weight were studied.

918. HO, H. H. 1971. The behavior of zoospores of *Phytophthora megasperma* var. *sojae* towards plant roots. Nova Hedwigia 19:601–622.

The pathogen and behavior of its zoospores are reviewed. Further detailed studies showed that zoospores were attracted to the roots and encysted rapidly on the surface. Cyst germination was enhanced, and germ tubes were initiated in the side of the cyst closest to the root and the germ tubes grew toward it. Encysted zoospores formed a sheath around the root, thickest behind the root tip. Zoospore accumulation was nonspecific with respect to host and nonhost, resistance and susceptibility.

919. HOLBERT, J. R., and W. L. BURLISON. 1931. Cold injury. Phytopathology 21:128. (Abstr.)

Three cultivars of soybeans, Wilson, Virginia, and Illini, differed greatly in susceptibility to cold injury.

920. HOLDEMAN, Q. L. 1950. Some falcate-spored *Colletotrichums* on legumes. Phytopathology 40:12–13. (Abstr.)

A number of falcate-spored *Colletotrichums* have been isolated from lima bean, soybean, red clover, and *Lotus* spp. These isolates have been divided into two types on the basis of cultural characters on potato-dextrose agar, type 1 producing a white cottony growth with scattered sclerotium-like acervuli and relatively few conidia, and type 2 producing a strict growth and abundant conidia. Since cultures of type 2 have been obtained as variants from type 1, this difference does not seem significant. Greenhouse inoculations on pods of soybean and lima bean with isolates from lima bean, soybean, and red clover have resulted in similar symptoms. When seedlings of soybeans and lima beans and plants of red clover were inoculated with these cultures, the lima bean culture was more pathogenic to lima beans and the soybean culture to soybeans. The red clover isolate was only weakly pathogenic. Another culture from lima bean was only slightly pathogenic to lima bean or soybean. In field experiments these fungi spread from one host to another.

921. HOLDEMAN, Q. L. 1950. Pod- and seed-spotting of soybean caused by *Helminthosporium vignicola.* Phytopathology 40:788. (Abstr.)

922. HOLDEMAN, Q. O., and T. W. GRAHAM. 1953. The effect of different plant species on the population trends of the sting nematode. Plant Dis. Reptr. 37: 497–500.

Soybean was a good host for sting nematode and high populations were recovered from this crop. Crops grown after soybean were severely damaged by this nematode.

923. HOLDEMAN, Q. O. 1955. The present known distribution of the sting nematodes, *Belonolaimus gracilis,* in the coastal plain of the southeastern United States. Plant Dis. Reptr. 39:5–8.

The sting nematode was recovered from soybeans from North Carolina, South Carolina, and Virginia.

924. HOLLINGS, M. 1972. Virology: Annual report Glasshouse Crops Res. Inst. Littlehampton, Sussex, 1971.

Cowpea mild mosaic virus is widespread in Ghana and induced severe disease in soybean.

925. HOLSTON, E. M., and H. W. CRITTENDEN. 1951. Resistance of soybeans to root-knot nematodes. Phytopathology 41:562. (Abstr.)

The cultivars Illini, Lincoln, Dunfield, Hawkeye, Richland, Wabash, Earlyana, and Chief were planted in a nematode-infested field to determine their resistance. Microscopic examination showed that the organism involved was *Meloidogyne incognita* var. *acrita.* Average root-knot indices for the above cultivars were, respectively, 5.5, 27.2, 30.9, 38.0, 45.8, 52.8, 55.9, and 16.4. In the greenhouse, the cultivars Illini, Wilson Black, Patoka, Richland, Lincoln, Chief, and Earlyana were planted. Average root-knot indices for this planting were 23, 37, 52, 77, 80, 87, and 89, respectively. Histological studies (infected roots treated with strong Flemming's solution) revealed that nematode population in the apparently resistant cultivar Illini was as high as in the severely knotted cultivar Chief; also, egg masses occurred in both cultivars at approximately the same date of maturity of the plants. This suggests that macroscopic examination of gall formation may indicate tolerance only, and not true resistance.

926. HONEY, E. E. 1944. Brown spot on soybean in Wisconsin. Plant Dis. Reptr. 28:656.

Records the occurrence of *Septoria glycines.*

927. HONEY, E. E. 1944. Soybean diseases in Wisconsin. Plant Dis. Reptr. 28:871–872.

Records the occurrence of mosaic virus, bud blight (tobacco ring spot virus), *Pseudomonas glycinea, Septoria glycines,* and *Peronospora manshurica.*

928. HONEY, E. E., J. G. DICKSON, and F. R. JONES. 1944. Diseases of soybeans in Wisconsin. Plant Dis. Reptr. 28:988–990.

Records the occurrence of *Pseudomonas glycinea, Peronospora manshurica,* bud blight (tobacco ring spot virus), mosaic virus, and *Septoria glycines.*

929. HOOKER, W. J. 1947. Parasitism of *Actinomyces scabies* on various plants. Phytopathology 37:10. (Abstr.)

An abstract of entry 930.

930. HOOKER, W. J. 1949. Parasitic action of *Streptomyces scabies* on roots of seedlings. Phytopathology 39:442–462.

In soil agar, *Streptomyces scabies* caused severe necrosis, especially at the root tips, and generally precluded the development of lateral roots in soybean and several other plants tested.

931. HOPKINS, J. C. F. 1931. Plant pathology in Southern Rhodesia during the year 1930. Rhodesia Agr. J. 28:384–389.

First records of the occurrence of *Macrophomina phaseoli* and *Helicobasidium* on soybeans in Rhodesia.

932. HOPKINS, J. C. F. 1932. A list of plant diseases occurring in Southern Rhodesia. Supplement 2. (June 1931–May 1932.) Rhodesia Agr. J. 29:462–467.

First report of *Bacterium glycineum* (= *Pseudomonas glycinea*) and mosaic virus for Southern Rhodesia.

933. HOPKINS, J. C. F. 1939. A descriptive list of plant diseases in Southern Rhodesia and their control. Southern Rhodesia Dept. Agr. Mem. 2. 51 pp.

Reports the occurrence of stem blight (*Ascochyta pisi* Lib.), *Macrophomina phaseoli* (= *M. phaseolina*) mosaic, *Rhizoctonia violacea* from Salisbury. Bacterial blight (*Pseudomonas glycinea*) destroys leaves in wet weather.

934. HOPKINS, J. C. F. 1950. A descriptive list of plant diseases in Southern Rhodesia and list of bacteria and fungi. Southern Rhodesia Dept. Agr. Mem. 2 (rev. 2nd ed.). 106 pp.

Lists the occurrence of *Ascochyta pisi* Lib., *Pseudomonas glycinea* Coerper, and a root rot (*Sclerotium rolfsii*) on soybean in the Salisbury area.

935. HORI, S. 1915. Phytopathological notes. 5. Sick soil of soybean caused by the nematodes [in Japanese]. J. Plant Prot. (Tokyo) 2:927–930.

Reports the first discovery of the soybean-cyst nematode, on the roots of soybean plant sent from where the disease had been observed for many years. Calcium cyanimide soil treatment is recommended for control.

936. HORN, N. L., L. D. NEWSOM, R. G. CARVER, and R. L. JENSEN. 1971. Effects of virus diseases on soybeans in Louisiana. Louisiana Agr. 13:12–13, 15.

A popular article, describing symptoms and losses caused by soybean mosaic and bean pod mottle virus on soybean. Varietal differences in yield loss were noted.

937. HORN, N. L., L. D. NEWSOM, and R. L. JENSEN. 1973. Economic injury thresholds of bean pod mottle and tobacco ring spot virus infection of soybeans. Plant Dis. Reptr. 57:811–813.

Economic injury thresholds of bean pod mottle virus (BPMV) and tobacco ring spot virus (TRSV) infection in soybeans in greenhouse and field experiments was determined to be more than 20% but less than 40% of the plant population. Effects of TRSV infection in the cultivars studied were about twice as severe as those of BPMV as measured by reduction in yield.

938. HORN, N. L., and F. LEE. 1974. Soybean (*Glycine max*), pod and seed disease and inhabiting fungi. Amer. Phytopath. Soc. Fungicide and Nematicide Tests, Results of 1973. 29:94.

Various soybean cultivars were treated with two applications of either benlate 50W, duter 50W or topsin M at the rate of 0.25, 0.5, and 1.0 lb./acre once when the pods were fully extended and the seeds began to swell and once 2 to 3 weeks later. Plant debris, which was soybean stubble collected from many Louisiana soybean fields in January, was mixed and macerated and spread over the ground around the test plants about 6 weeks after planting. Objective of the experiment was to control the pod and seed disease and inhabiting organisms associated with soybeans, including species of *Cercospora, Diaporthe, Corynespora, Fusarium, Colletotrichum, Rhizopus, Penicillium, Aspergillus, Alternaria,* and *Rhizoctonia.* Topsin-M treated Dare plots were analyzed separately from the benlate 50W and duter 50W plots. Benlate delayed maturity from 5–14 days and duter 50W and topsin M 3–7 days depending on the cultivar. The later the cultivar the longer the delay in maturity. Leaves and stems particularly remained green longer than pods.

939. HOWARD, F. L. 1942. An undetermined, apparently virus, disease of edible soybean in Rhode Island. Plant Dis. Reptr. 26:381.

An outstanding crinkle or rugose symptom was found on all of 21 cultivars grown in the experimental plot.

939a. HOWELL, R. K. 1974. Soybean seed yields influenced by oxidant air pollutants in Maryland. Proc. Amer. Phytopath. Soc. 1:151. (Abstr.)

The effect of ambient concentrations of oxidant air pollutants on yield of commercially important soybean cultivars was investigated. Two criteria were imposed: (1) Cultivars had to be adapted to the area, and (2) the experiment had to be conducted in an area where the

crop is important. The cultivars York, Dare, Cutler, and Clark were subjected to carbon-filtered (CF), nonfiltered (NF), or ambient (AA) air on the eastern shore of Maryland. The experiment was established on 6 June 1973, by placing seed of the cultivars in soil as routinely prepared for soybean culture. Oxidant concentrations were monitored between July 1 and September 15, and found to be comparable to those in the Washington metropolitan area. Yields of beans from NF, CF, and AA plots were 36, 55, and 56 bu./acre, respectively. Yields of beans were significantly reduced by NF air imposed on plants cultured in chambers. Since air quality in the NF chamber and in the AA plots is presumed to be the same, yield reduction caused by NF air in chambers is probably due to the combination of environmental conditions to enhance stomatal opening and to potentially larger quantities of air pollutants being forced across leaves contained in chambers. These conditions provide the possibility for maximum uptake of contaminated air.

940. HSU, J. S. 1944. Variability of monoconidial cultures of *Glomerella glycines*. Chinese J. Expt. Biol. 2:13–22.

Monoconidial strains of the fungus were found to vary in morphology, growth rate, reaction to temperature and acidity, sugar requirement, and pathogenicity.

941. HU, C. H. 1963. A preliminary report of the effects of root-knot nematodes, *Meloidogyne* spp., on the growth of sugarcane and its interplanted crops [in Chinese, English summary]. Taiwan Sugar Expt. Sta. Rpt. 31: 121–136.

Soybeans grown in sterilized sea sand inoculated with root-knot nematodes showed severe galling and stunting of plants.

942. HUNG, C. H., and K. C. LIU. 1961. Soybean spraying experiment for rust disease control [in Chinese, English summary]. Agr. Res. (Taiwan) 10:35–40.

Phakopsora pachyrhizi (rust) is one of the destructive diseases found throughout the growing areas of Taiwan. Either dithane M-22 or dithane Z-28 + wettable S, 0-3818B or bordeaux mixtures applied to soybean at 7-day intervals, five times through the growing season gave best control.

943. HUNG, Y. 1958. A preliminary report on the plant-parasitic nematodes of soybean crop of the Pingtung District, Taiwan, China [in Chinese]. Agr. Pest News 5(4):1–5.

Based on this study, *Meloidogyne arenaria* is the most dominant (serious) nematode. This kind of nematode usually is found on dry-sandy loam or sandy soil, which is used for dry-land farming and not for rice production. This nematode never appears where rice rotation is practised. Another kind of soybean nodule nematode, the soybean-cyst nematode *Heterodera glycines* Ichinohe, is not found in this area but it was reported in Shin-chu area, the United States, and Japan. The next important parasitic nematodes are *Helicotylenchus* sp.? and *Rotylenchus* sp., which can be found anywhere and in great numbers. *Pratylenchus* sp. were found in four locations during the investigation but only in small numbers and caused little or no damage. The nodule nematode *M. arenaria* also damages fiber crops in this area. They build up and will damage soybean crops. Under present conditions the control of nodule nematodes is based on breeding resistant cultivars and establishing a satisfactory system of crop rotation.

944. HURST, C., B. W. KENNEDY, and L. OLSON. 1973. Production of ammonia by tobacco and soybean inoculated with bacteria. Phytopathology 63:241–242.

Ammonia was consistently produced by tobacco leaves inoculated with *Pseudomonas tabaci*. There was no correlation between susceptible, resistant, or hypersensitive reaction and evolution of ammonia by tobacco or soybeans. Soybean leaves and callus tissue inoculated with bacteria produced no more ammonia than did the controls.

945. HUSSAIN, T., and M. KAMAL. 1970. Studies on the survival of *Macrophomina phaseoli* (Maubl) Ashby causing stem rot of soybean. J. Agr. Res. Lahore 8:291–296.

Supplies data on survival of *Macrophomina phaseoli* (= *M. phaseolina*), its saprophytic behavior, transmission to crops, and the effect of certain fungi.

946. IAKIMOVICH, E. D. 1938. Virus diseases of soybeans [in Russian]. Moscow Vsesoiuz. Nauch.-Issled. Inst. Severnogo Zernovogo Khoz. i Zernobob. Kul'tur, Trudy 3:79–115.

947. IAKIMOVICH, E. D. 1938. Virus diseases of the soybean [in Russian]. *In* M. S. Dunina (ed.) [Virus diseases of plants.] Collection 2:226–227.

948. IBRAHIM, I. K. A., I. A. IBRAHIM, and S. I. MASSOUD. 1972. Induction of galling and lateral roots on five varieties of soybean by *Meloidogyne javanica* and *M. incognita*. Plant Dis. Reptr. 56:882–884.

The effects of *Meloidogyne javanica* and *M. incognita* on growth of soybean cultivars Lee, Hampton, N.C. Hampton, Laredo, and Delmar were investigated. When number of nematode galls was used as an index for infection and susceptibility, the tested cultivars showed variable degrees of susceptibility to *M. javanica*. Lee developed the highest number of galls, followed by Hampton, N.C. Hampton, Laredo, and Delmar. Laredo and Delmar were relatively resistant to *M. incognita*, but the other cultivars were susceptible. Roots of Lee infected by either nematode species formed more lateral roots than did healthy plants. Lateral roots of Hampton were significantly reduced by infection by either nema-

tode species; Laredo and Delmar roots were not affected. Dry weight of the root and shoot systems of tested cultivars infected by either *M. javanica* or *M. incognita* could not be used as a reliable index for susceptibility.

949. ICHINOHE, M. 1952. [On the soybean nematode, *Heterodera glycines* n.sp., from Japan.] Oyo-Dobutsugaka-Zasshi (Mag. Appl. Zool.) (Soc. Appl. Zool., Tokyo) 17(1/2):1–4.

Describes a new species of *Heterodera glycines* as follows: Cyst lemon-shaped, length 0.690 (0.87–0.56) mm, breadth 0.489 (0.67–0.35) mm, length/breadth 1.406 (1.6.–1.20). Color white at first, then pale yellow while living. Gelatinous egg sac present; a few eggs extruded by largest cysts only. Punctuation very coarse, conspicuous, with a tendency toward the parallel rows. Surface reticulation faint and wavy. Subcrystalline layer present. Males — length $1313 \pm 98\mu$, breadth $32.8 \pm 2.0\mu$. Stylet stout and comparatively short, measuring $26.8 \pm 0.26\mu$. Spicules bifid-tipped. Larvae — $484 \pm 21.3\mu$ in length. Eggs — length $106.3 \pm 2.06\mu$, breadth $42.5 \pm 1.05\mu$, length/breadth 2.50.

950. ICHINOHE, M. 1953. On the parasitism of the soybean nematode, *Heterodera glycines* [in Japanese, English summary]. Hokkaido Natl. Agr. Expt. Sta. Res. Bull. 64, pp. 113–124.

Heterodera glycines attacks soybean most severely, azuki bean slightly, kidney bean and Spanish runner bean in traces. In the experiment it was found that *H. glycines* attacks soybean and azuki most severely. Females were found on roots of kidney beans though rate of larval development in all hosts was almost identical. Young females in roots of kidney bean did not fully develop, resulting in small size of adult females and hence decreased production of eggs. Parasite invaded the pea and broad beans but did not develop further. Such crops can be used as trap-crops for control of this pest.

951. ICHINOHE, M. 1955. Survey on the "yellow dwarf" disease of soybean plants caused by *Heterodera glycines* occurring in the peat soil in Hokkaido [in Japanese, English summary]. Japan. J. Ecol. 5:23–26.

Glycine ussuriensis proved to be a host of *Heterodera glycines.* This plant showed typical symptoms in the above-ground parts and seems similar to soybean in susceptibility to this nematode. *G. ussuriensis* is a wild type of soybean and grows naturally in Honshu. The nematode was found in three patches in a field of peat soil where it was thought that the nematodes had increased in clayey loam rich in humus with which the peat soil had been mulched.

952. ICHINOHE, M. 1955. Studies on the morphology and ecology of the soybean cyst nematode, *Heterodera glycines,* in Japan. Hokkaido Natl. Agr. Expt. Sta. Rpt. 48, pp. 1–65.

Detailed article describing distribution, host range, morphology of male and female, and life cycle of *Heterodera glycines.*

953. ICHINOHE, M. 1955. A study of the population of the soybean nematode *Heterodera glycines.* I. An observation on the relation between the crop damage and the female infestation [in Japanese, English summary]. Hokkaido Natl. Agr. Expt. Sta. Res. Bull. 68, pp. 67–70.

Using the number of pods per plant as a criterion of crop damage in soybeans, it is shown that in general there were fewer female *Heterodera glycines* on heavily damaged and on lightly damaged plants than on soybean showing medium damage. A table shows number of pods per plant, seed yield, height of plants, number of females per plant, and frequency in different categories of plant damage.

954. ICHINOHE, M., and K. ASAI. 1956. Studies on the resistance of soybean plants to the nematode, *Heterodera glycines.* I. Varieties Daiichi-hienuki and Nanguntakedate [in Japanese, English summary]. Hokkaido Natl. Agr. Expt. Sta. Res. Bull. 71, pp. 67–79.

Two resistant and two susceptible cultivars of soybeans were tested in soils equally inoculated with *Heterodera glycines.* Resistant cultivars Daiichi-hienuki and Nanguntakedate showed no stunting or reduced yield, whereas susceptible cultivars Kokuso and Tokachi-nagaha suffered severe disease symptoms and yield reduction. Resistance took the form of failure of the majority of within-host larvae to survive. Root systems of resistant plants were large with a higher density of root nodules than occurred on the susceptible cultivars, though most plants grown in infested soil had fewer root nodules than normal.

955. ICHINOHE, M. 1959. Studies on the soybean-cyst nematode, *Heterodera glycines* and its injury to soybean plants in Japan. Plant Dis. Reptr. Suppl. 260:239–248.

A general study is made of the soybean-cyst nematode, distribution, morphology, symptoms, hosts, and control, including use of resistant cultivars and chemicals.

956. ICHINOHE, M. 1961. Studies on the soybean-cyst nematode, *Heterodera glycines* [in Japanese, English summary]. Hokkaido Natl. Agr. Expt. Sta. Rpt. 56. 80 pp.

This is a comprehensive account of the morphology, bionomics, and control of *Heterodera glycines* based on the author's studies during 1949–1958 at Hokkaido. The main topics include morphology of various stages, systematics, nematode development on a nonhost plant grafted to host-plant stock, relationships between plant damage and eelworm population, populations in cropping host and nonhost plants, populations in a plot cropped successively with soybeans, resistance of soybean cultivars to the eelworm, control by cropping, and the

present situation and future prospects of chemical control in Japan.

957. IGNATOSKI, J. A. 1967. Host-parasite interaction of enzyme separated cells of soybean leaves and *Xanthomonas phaseoli* var. *sojense*. Diss. Abstr. 28:421–422.

Interactions were defined by measuring the changes in the growth rate of *X. ph.* var. *sojense* incubated with enzyme separated cells. The differences recorded in interaction with cells of resistant Lee and susceptible Blackhawk may reflect host-parasite interaction, because no differences were observed between cultivars in their interaction to a saprophytic bacteria.

958. IIDA, W. 1951. Studies on soybean anthracnose [in Japanese, English summary]. Pflanzenkrank., Kyoto 4: 169–173.

The causal fungus of soybean anthracnose, *Glomerella glycines,* was isolated from diseased pods. Optimum temperature for growth in culture was 28 to 30 C and the range 4 to just over 40 C. Conidia of this isolate failed to germinate at a relative humidity below 95%, while the optimum temperature range for germination was between 26 and 32. The hyphae of *G. glycines* were able to overwinter in diseased pods. In inoculation tests only the pods, particularly young ones, were susceptible to infection.

959. IIZUKA, N., and I. IIDA. 1961. On lucerne mosaic virus isolated from ladino clover [in Japanese]. Ann. Phytopath. Soc. Japan 26:69. (Abstr.)

Inoculation of soybean with the virus produced systemic infection. Virus was sap-transmitted and also transmitted by *Aphis medicaginis, Myzus persicae,* and *Macrosiphum pisum.* The virus was isolated from ladino clover.

960. IIZUKA, N. 1973. Seed transmission of viruses in soybean [in Japanese]. Tohoku Natl. Agr. Expt. Sta. Bull. 46, pp. 131–141.

Soybean mosaic virus (SMV) was seed-transmitted to 34% of the progeny in soybeans but not in *Phaseolus vulgaris* or *P. lunatus.* Soybean stunt virus (SSV) was seed-transmitted 95% in soybean, 5% in cowpea, but not in *P. lunatus.* Tobacco ring spot virus (TRSV) was seed-transmitted 100% in soybean, 46% in *Gomphrena globosa,* 21% in lettuce, and 5% in zinnia, but not in pea, *P. angularis* or *Physalis floridana.* Alfalfa mosaic virus (AMV) and bean yellow mosaic virus (BYMV) were not seed-transmitted in soybean, bean or pea. Transmission rate varied in different soybean cultivars. Plants inoculated with SMV or SSV just before flowering produced fewer infected seed than those inoculated earlier. Both viruses could be transmitted through pollen or ovules in crosses of infected and healthy plants. SMV, SSV, AMV, and BYMV were present in all immature seed coats of infected plants, and SMV and SSV occurred in some embryos as well.

961. IKATA, S., and K. YAMAUTI. 1941. Notes on the haustoria of some species of *Peronospora* [in Japanese]. Ann. Phytopath. Soc. Japan 10:326–328.

The haustoria of *Peronospora manshurica* in soybean cells twist when young, coiling at maturity to resemble intestines, and measure 70 × 0.8–3.0μ.

962. IKATA, S. 1951. The diseases of feed crops. 1. Rice plant and beans [in Japanese]. Tokyo, Asakura Shoten, Plant Path. Ser. 6, p. 334.

A well-illustrated, comprehensive work that appears to be a review. Soybean diseases dealt with include downy mildew, *Peronospora manshurica;* brown spot, *Septoria glycines;* bacterial blight, *Bacterium sojae* var. *japonicum* (= *Pseudomonas glycinea*); purple speck, *Cercospora kikuchii;* frog-eye leaf spot, *Cercospora daizu* (= *C. sojina*); anthracnose, *Glomerella glycines;* and rust, *Phakopsora sojae* (= *P. pachyrhizi*).

963. IKENO, S. 1933. Studies on Sclerotium disease of the rice plant. VIII. On the relation of temperature and period of continuous wetting to the infection of soybean by the sclerotia of *Hypochnus sasakii* Shirai and on autolysis of the same fungus. Forsch. Geb. Pflanzenk. (Kyoto) 2:238–256.

The minimum periods of continuous wetting necessary for infection of soybean were found to be about 24 hr. at 24 C and 18 hr. at 28 and 32 C. With injured soybean leaves the minimum periods are 24 hr. at 20 and 24 C, 18 hr. at 28 C, and 12 hr. at 32 C. Negative results were obtained in the tests at 34 C and 36 C.

964. ILYAS, M. B., and J. B. SINCLAIR. 1973. Effect of plant age and xylem sclerotia of *Macrophomina phaseoli* on charcoal rot development in soybean. 2nd Internatl. Cong. Plant Path. Abstrs.: 1060.

An abstract of entry 965.

965. ILYAS, M. B., and J. B. SINCLAIR. 1974. Effects of plant age upon development of necrosis and occurrence of intraxylem sclerotia in soybean infected with *Macrophomina phaseolina.* Phytopathology 64:156–157.

Soybean plants up to 60 days of age were wound-inoculated at 10-day intervals with mycelium of *Macrophomina phaseolina* (*Rhizoctonia bataticola*). Pith necrosis increased significantly with each increase in plant age. Intraxylem sclerotia were produced in stems of 30-, 40-, 50-, and 60-day-old plants. Symptoms of charcoal rot in soybean have been attributed to enzymes and toxin production. Data reported here indicate that sclerotia in xylem vessels also contribute to wilting and death of infected plants.

966. INAGAKI, H., and M. TSUTSUMI. 1971. Sur-

vival of the soybean cyst nematode, *Heterodera glycines* Ichinohe (Tylenchida: Heteroderidae) under certain storing conditions. Appl. Ent. Zool. 6:156–162.

Viability of encysted eggs and larvae of *Heterodera glycines* stored in soil up to 11 years was studied. Two cyst-containing soil samples were taken from nematode-infested soybean fields. One sample was air-dried (soil moisture 7.0%) and the other was not dried (soil moisture 25.9%). The soils were held in plastic bags and stored in a room without any temperature control. Viability examinations done every year revealed that the encysted eggs of this nematode were able to survive 9 years in the air-dried conditions and to infect soybean roots for 7 years in both moisture conditions.

967. Information from the department of botany and plant pathology 1938 [in Spanish]. Venezuela Min. de Agr. y Cria, Mem. Adicional Vol. (Labores Tec.) 2:41–72.

In 1937 *Cercospora glycines* (leaf spot), *Ascochyta pisi* (leaf spot), and *Bacterium sojae* (= *Pseudomonas glycinea*) (on leaves) were collected on soybean.

968. IRWIN, J. A. G. 1973. Verticillium wilt of soybean. Australian Plant Path. Soc. Newsltr. 2:18.

Verticillium dahliae wilt is reported for the first time on soybean in Australia.

969. ISHIKAWA, T. 1916. Principal insect pests and diseases occurring during the fourth year of Taisho. II. Occurrence of "moon night" and wilt disease of soybean. J. Plant Prot. (Tokyo) 3:197.

A report of the occurrence for many years of the soybean disease called "moon night disease." Reported that the land became incapable of cropping soybean because of the disease.

970. ISHIYAMA, T. 1936. New or noteworthy fungi parasites on agricultural plants in southern Saghalien. Trans. Sapporo Nat. Hist. Soc. 14:297–308.

Includes a description of *Ascochyta sojaecola.*

971. ISIKAWA, M., and T. MIYAHARA. 1958. Reaction of soybean varieties to the soybean nematode (*Heterodera glycines*) [in Japanese, English summary]. Japan. J. Breed. 8:111–118.

Among 64 soybean cultivars tested in 1956 and 49 tested in 1957, the authors found that the following eight cultivars were highly resistant to the soybean-cyst nematode *Heterodera glycines:* Nangun-takedate, Tanryoku (2), Meguro, Geden-shirazu No. 1, Takedate No. 1, Iwate-yagi No. 1, Iwate No. 2, and Daiichihienuke. All are late-ripening cultivars in Tôhoku district (the northeastern district of Honshû). The authors also studied the correlation between susceptibility of soybean cultivars to this nematode and growth of the plants.

972. ITO, K. 1949. Studies on "Murasaki-mompa" disease caused by *Helicobasidium mompa* Tanaka. Tokyo Govt. Forest Expt. Sta. Meguro Bull. 43, pp. 126.

Sterilized seed were sown in autoclaved pots on April 30. On June 14 small bits of mycelium from a pure culture were used to inoculate the soil. By September 16 both large and small roots were covered with purplish-brown rhizomorphs of the fungus. In some parts of the heavily attacked roots the parenchymatous tissues were destroyed so completely that only the periderm and stele portion retained their original shape. On the root surface, pinhead-shaped sclerotia were formed abundantly. Cultural characteristics, morphology, taxonomy, physiology, and cytology of the fungus are discussed. The fungus is known to occur in Japan, Formosa, Korea, and Manchuria.

973. ITO, K. 1952. Immunity of the gramineous plants to the violet root rot. Agr. and Hort. Tokyo 27:85–86.

Soybean and sweet potato were severely attacked by *Helicobasidium mompa* but maize, upland rice, wheat, and millet remain immune to infection by this fungus.

974. ITO, K., and T. KOBAYASHI. 1958. Studies on some anthracnoses of woody plants. V. Anthracnose fungi of black locust. Tokyo Govt. For. Expt. Sta. Meguro Bull. 108, pp. 1–29.

A natural infection suspected to be *Colletotrichum glycines* (= *C. dematium* f. *truncata*) severely attacked black locust seedlings in a nursery, causing up to 80% infection and killing seriously affected plants. Cross-inoculation studies, with isolates from soybean and black locust, showed that they were pathogenic to both species but were slightly more pathogenic on their original hosts.

975. ITO, S. 1921. Studies on "yellow dwarf" disease of soybean [in Japanese]. Hokkaido Agr. Expt. Sta. Rpt. 11, pp. 47–59.

A study of the soybean-cyst nematode is made. The disease was named "soybean yellow dwarf disease" because of the yellowish discoloration of the diseased plants.

976. ITO, S. 1936. Phycomycetes [in Japanese]. Mycol. Flora Japan 1:205.

Includes a description of *Peronospora manshurica.*

977. ITO, S. 1941. Uredinales [in Japanese]. Mycol. Flora Japan 2:1–141.

Includes a description of *Phakopsora pachyrhizi.*

978. IWADARE, S., et al. 1943. A list of the diseases of cultivated plants in Manchuria [in Japanese]. Manchuria Agr. Expt. Sta. Rpt. 45, pp. 1–223.

The following pathogens and diseases of soybeans are described: *Heterodera schachtii, Bacterium glycineum* var. *japonicum* (= *Pseudomonas glycinea*), *B.* (= *Xanthomonas*) *phaseoli* var. *sojense, Peronospora manshurica,*

Septoria glycines, Cercospora sojina, Pleosphaerulina sojaecola, Macrophoma mame, Mycosphaerella sojae, Colletotrichum glycines (= *C. dematium* f. *truncata*), *Phakopsora pachyrhizi, Gibberella* sp., *Ascochyta sojae, Sclerotinia libertiana* (= *Whetzelinia sclerotiorum*), *Cercosporina* (= *Cercospora*) *kikuchii,* mosaic, *Cuscuta chinensis,* and brown spot of seed of unknown cause.

979. IWATA, K. 1941. A basic test on the control of "yellow dwarf" disease of soybean by rotations [in Japanese]. Noygo-oyobi-Engei. 16:429–435.

Five- and 6-year rotation systems such as sugar beet-wheat-corn-potato-soybean croppings or flax-oat-pea-corn-soybean for a 5-year rotation system were found almost perfect for obtaining good yields of soybean and for starving cyst nematodes.

980. JACKSON, N. E., R. H. MILLER, and R. F. FRANKLIN. 1973. The influence of vesicular-arbuscular mycorrhizae on uptake of ^{90}Sr from soil by soybean. Soil Biol. and Biochem. 5:205–212.

Soybean seedlings supplied with *Endogone mosseae* inoculum absorbed significantly more ^{90}Sr than nonmycorrhizal controls after 1, 3, or 7 days' contact with ^{90}Sr amended sterilized or nonsterilized soil. The same phenomenon was observed in a second study which allowed for ^{90}Sr uptake concurrent with mycorrhizal infection and development. In the first study, soil sterilization exerted a 1-day negative effect on ^{90}Sr uptake by mycorrhizal roots. In the second, the mycorrhizal roots absorbed more ^{90}Sr from sterilized than from nonsterilized soil while the reverse occurred in control plants. Infected plants in both studies showed an early decrease in dry matter.

981. JACZEWSKI, A. A. 1928. Concerning diseases of oil seed plants [in Russian]. Oil and Fats Prod. Ind. 4:1–11.

Lists the diseases of four leguminous oil crops found in Russia including soybean.

982. JAGOE, R. B., and E. F. ALLEN. 1952. Notes on current investigations, July to September, 1952. Malayan Agr. J. 35:218–227 and Fed. Malayan States Dept. Agr. Ann. Rpt. 1952, p. 39.

Corticium solani, the perfect stage of *Rhizoctonia solani,* was found for the first time in Malaya on soybeans.

983. JAMIL, M. 1964. Annual report of the Dept. of Agr. Federations of Malaya for the year 1961. 85 pp.

New record of soybean mosaic virus on soybean in Malaya.

984. JAN, C., and L. WU. 1971. Chemical control of soybean rust [in Chinese, English summary]. Mem. Coll. Agr. Natl. Taiwan Univ. 12(1):173–190.

Results are presented on germination of *Phakopsora pachyrhizi* uredospores on 1% water agar incorporated with various chemicals, and effects of growth regulators and chemicals on infected soybeans. Benlate, sankyo, bordeaux (containing phenyl mercury acetate), plantvax 75W, dithane M45, and o-methylbenzoic acid amilide, not only reduce disease incidence and defoliation but also increase 1,000-seed weight. Dithane and benlate gave the best control.

985. JEHLE, A. A., A. E. JENKINS, K. W. KREITLOW, and H. S. SHERWIN. 1952. An outbreak of Phyllosticta canker and leaf spot of soybeans in Maryland. Plant Dis. Reptr. 36:155–158.

Symptoms appear as small, gray to almost white with purplish borders, superficial cankers on stem. Pod and peduncle cankers are also common. Pod lesions may extend up to the seed. Leaf spotting results in defoliation. On leaves the necrotic brown lesions appear usually at the margin but sometimes scattered over the entire leaf. Pycnidia of the fungus are abundant on the lesion. The causal fungus was identified as *Phyllosticta sojaecola.*

986. JENKINS, A. E. 1951. Sphaceloma scab, a new disease of soybeans discovered by plant pathologists in Japan. Plant Dis. Reptr. 35:110–111.

Reports of the disease occurrence in Japan. The symptoms appear on leaves, stem, and pods as hyperplastic lesions. On leaves they are circular to irregular, more or less raised. On stem they range from minute to elliptical-elongate, vinaceous buff with reddish margins. On pods they are generally red to brown becoming dark olive to black with paler centers and reddish-brown margin.

987. JENKINS, L. 1963. Nematode research from 1956–1962 in Missouri. Missouri Res. Bull. 833, pp. 14–17.

Meloidogyne incognita var. *acrita* and *Heterodera glycines* are problems facing soybean growers. Treatments with a nematicide gave good control of nematodes. Early-planted soybeans were less severely damaged than late-planted in cyst-infected soils. Nematicidal treatment with dibromochloropropane reduced the damage due to root-knot nematode.

988. JENKINS, W. R., B. W. COURSEN, R. A. ROHDE, and D. P. TAYLOR. 1956. Occurrence of cyst nematodes, *Heterodera* spp. in Maryland. Plant Dis. Reptr. 40:869.

Cyst nematodes (*Heterodera*) were found in 29.6% of 260 farm samples. There was no evidence that these cyst nematodes were parasitizing soybeans although no other plants were present in the area samples.

989. JENKINS, W. R., D. P. TAYLOR, R. A. ROHDE, and B. W. COURSEN. 1957. Nematodes associated with crop plants in Maryland. Univ. Maryland Bull. A-89. 25 pp.

In a survey conducted in Maryland, the following nematode genera and species were associated with soybean: *Aphelenchoides; Aphelenchus; Hoplolaimus coronatus; Helicotylenchus nannus, H. erythrinae; Pratylenchus* spp., *P. pratensis, P. brachyurus, P. penetrans, P. hexincisus; Ditylenchus* spp.; *Tylenchorhynchus claytoni; Psilenchus; Tylenchus; Heterodera schactii*-group, *H. cacti*-group; *Meloidogyne incognita acrita; Criconemoides* spp.; *Paratylenchus* spp., *P. projectus; Xiphinema americanum; Longidorus* sp.; *Trichodorus; Neotylenchus; Nothotylenchus;* and *Dorylaimus.*

990. JOHNSON, A. G., and F. M. COERPER. 1917. A bacterial blight of soybean. Phytopathology 7:65. (Abstr.)

For a number of years this disease has been under investigation at Madison, Wis. Apparently the same malady has also been reported from other parts of the United States. At Madison the disease has been common during the past three years, especially on the leaves. These leaf lesions are small, rather angular spots, in late stages, dark in color, brown to purplish black. In the earlier stages they are translucent and water-soaked in appearance and yellowish to light brown in color. The lesions may be irregularly scattered or variously grouped and they not uncommonly coalesce. Rather inconspicuous glistening films of exudate are frequently noticeable on lower surfaces of the lesions. Repeated isolation cultures have yielded a characteristic, white bacterial organism which has proved pathogenic on soybean, producing characteristic lesions as described above. The same organism has been reisolated from such lesions and its pathogenicity in turn proved. This organism is a rod with rounded ends, motile by a single polar flagellum, hence referable to the genus *Pseudomonas* of Migula or the genus *Bacterium* of Ehrenberg as interpreted by Erwin F. Smith. Studies on physiological characteristics of the organism and its pathogenicity on other leguminous hosts are in progress.

991. JOHNSON, A. W., and C. J. NUSBAUM. 1968. The activity of *Tylenchorhynchus claytoni, Trichodorus christiei, Pratylenchus brachyurus, P. zeae,* and *Helicotylenchus dihystera* in single and multiple inoculations on corn and soybean. Nematologica 14:9. (Abstr.)

Population dynamics of certain species of plant parasitic nematodes were studied in greenhouse inoculation experiments with corn and soybean. *Pratylenchus zeae, Tylenchorhynchus claytoni* and *Trichodorus christiei,* alone and in all combinations, were used with five corn cultivars and lines representing a broad range of genotypes. Likewise *P. brachyurus, T. christiei,* and *Helicotylenchus dihystera* were used on five cultivars of soybean. Initial population densities for each nematode species, whether used alone or in combination, were calibrated at about 1,000 nematodes per kg of soil. Final population densities were determined by appropriate assay techniques 50 days after inoculation. In the corn experiment, all cultivars and lines were suitable hosts for each species but variations in final population densities for each species were influenced not only by the host cultivar but also by the presence of other nematode species in the combination treatments. In combination with *T. christiei,* populations of *P. zeae* were higher on Seneca Chief and Tehua Hopi than where *P. zeae* was used alone. Similarly in the presence of *P. zeae,* populations of *T. christiei* were higher on all cultivars than where *T. christiei* was used alone. *T. christiei* populations were suppressed in combination with *T. claytoni* on Tehua Hopi and *T. claytoni* populations were suppressed by *T. christiei* on all cultivars except Tehua Hopi and Syn 22.

In the soybean experiment all three species when used singly reproduced readily on all cultivars, and variations in final population densities were influenced by treatments as well as cultivars. Populations of *P. brachyurus* were adversely affected by the presence of either one or both of the other species on most cultivars. However, the presence of *P. brachyurus* increased the populations of *T. christiei* on Hill, Jackson, and Harosoy and decreased the populations of *H. dihystera* on Hill and Pickett. Populations of the latter also were suppressed in the three-species combination treatment on cultivars Jackson, Harosoy, and Pickett. In most cases, however, three-species combination treatments were not significantly different from the two-species combinations involving the singly most influential species. Also, in most cases the population dynamics of each species were influenced by certain other species sharing the same host plant.

992. JOHNSON, F. 1943. Brief notes on plant diseases. Soybean streak in Ohio. Plant Dis. Reptr. 27:86–87.

Only a small percentage of plants were infected with the virus. Diseased plants were characterized by a bronzing of foliage, and growing stem tips were brittle and showed numerous small, necrotic streaks. Such plants were considerably stunted and produced considerably fewer pods. The virus was sap-transmitted to cowpea and tobacco.

993. JOHNSON, H. W., and C. L. LEFEBVRE. 1942. Downy mildew on soybean seeds. Plant Dis. Reptr. 26: 49–50.

Soybean seeds infected by downy mildew appeared to be covered with a milky-whitish crust of oospores of *Peronospora manshurica* and the coats were crinkled and cracked. Morphology of oospores is described.

994. JOHNSON, H. W., and B. KOEHLER. 1943. Soybean diseases and their control. U.S. Dept. Agr. Farmers' Bull. 1937.

Brief popular accounts are given on the following diseases: bacterial blight, bacterial pustule, pod and stem blight, frog-eye spots, brown spot, anthracnose, downy mildew, Alternaria leaf spot, arsenical injury, mosaic,

chlorosis due to deficiencies of K_2O, Fe, and N, seed discolorations associated with *Cercospora* and *Alternaria,* charcoal rot, sclerotial blight, Fusarium blight, root rots, and lightning injury.

995. JOHNSON, H. W. 1950. Plant disease research on forage crops in the bureau of plant industry, soils, and agricultural engineering. Plant Dis. Reptr. Suppl. 191:42–59.

Soybean research is reviewed. Two types of *Diaporthe* occur on soybean. One, *D. phaseolorum* var. *sojae,* is heterothallic, produces scattered single perithecia and conidia of *Phomopsis.* It is less pathogenic than *D. p.* var. *batatatis* (= *D. p.* var. *caulivora*) which is homothallic and produces caespitose clusters of perithecia, lacks conidial stage, and is an active parasite. *Macrophomina phaseoli* (= *M. phaseolina*) is variable pathogenically, and a weak parasite. Infection is limited to young seedlings, senescent plants, and plants growing under stress. Low soil moisture contributes to disease development. *Peronospora manshurica* infects leaves and seeds. Seed have a milky appearance and are encrusted with oospores. Planting infected seeds gives rise to systemically infected plants. Reports on occurrence and distribution of bud blight, wildfire, and brown stem rot. Cultivars CNS and Ogden are highly resistant to bacterial pustule. Seed treatment with arasan and spergon gave best stand of low-quality seeds. Dusting with Cu dust controlled bacterial diseases and increased yield. And tri-basic $CuSO_4$ reduced *Cercospora kikuchii* in seed.

996. JOHNSON, H. W. 1951. Soybean seed treatment. Soybean Dig. 8(7):17–20.

Treating seed with arasan and spergon resulted in increased emergence in 4-year tests. Slurry method of seed treatment was found satisfactory. Cerasan dust also resulted in significantly better emergence. Vanicide 51 also improved emergence. Phygon, yellow cuprocide, and dow 9B were not effective. Treatment of poorer-germinating seed significantly increased emergence. Yield from treated plots was higher than from nontreated plots. Seed treatment maintains the germinativity of seeds stored 6–18 months.

997. JOHNSON, H. W., and R. A. KILPATRICK. 1953. Soybean diseases in Mississippi in 1951–1952. Plant Dis. Reptr. 37:154–155.

Records occurrence and prevalence of *Xanthomonas phaseoli, Pseudomonas glycinea, P. tabaci, Peronospora manshurica* (the oospore of the fungus encrusted the seeds), *Phyllosticta* sp., *Corynespora cassicola, Cercospora sojina, Alternaria* sp., *Diaporthe phaseolorum* var. *sojae, Sclerotium bataticola* (= *Macrophomina phaseolina*), *S. rolfsii, C. kikuchii, Colletotrichum* sp., soybean mosaic virus, and yellow bean mosaic virus.

998. JOHNSON, H. W., and D. W. CHAMBERLAIN. 1953. Bacteria, fungi, and viruses on soybeans. *In* Plant diseases, yearbook of agriculture, pp. 238–247. U.S. Dept. Agr., ARS, Washington, D.C.

A brief review of literature of soybean diseases caused by various agents.

999. JOHNSON, H. W., D. W. CHAMBERLAIN, and S. G. LEHMAN. 1954. Diseases of soybeans and methods of control. U.S. Dept. Agr. Circ. 931.

General description of soybean diseases.

1000. JOHNSON, H. W., D. W. CHAMBERLAIN, and S. G. LEHMAN. 1955. Soybean diseases. U.S. Dept. Agr. Farmers' Bull. 2077.

Nontechnical description of soybean diseases, primarily for farmers, elevator men, and farm advisers.

1001. JOHNSON, H. W., U. M. MEANS, and F. E. CLARK. 1958. Factors affecting the expression of bacterial-induced chlorosis of soybeans. Agron. J. 50:571–574.

Modifications of nutrient solution and sand substrate and cotyledon removal treatments markedly influenced the onset and severity of bacterial-induced chlorosis in soybean. Although the severity of chlorosis in Hawkeye varied markedly, the cultivar was readily classed as susceptible in treatments. Blackhawk developed light to moderate chlorosis in all treatments except one, in which it appeared to be completely resistant. Removal of one or both cotyledons at the unifoliolate leaf stage resulted in essentially equal chlorosis in Hawkeye and Blackhawk, whereas their responses to other treatments were greatly different. The cultivars Harosoy and CNS, previously considered completely resistant, developed uniform chlorosis in one treatment; however the severity of chlorosis in more susceptible cultivars in the same treatment was not increased over that in other treatments. Genotype-environment interactions involved in the expression of chlorosis and characteristics of the chlorosis are discussed.

1002. JOHNSON, H. W., U. M. MEANS, and F. E. CLARK. 1959. Response of seedlings to extracts of soybean nodules bearing selected strains of *Rhizobium japonicum.* Nature 183:308–309.

Effect of extracts from nodules of *Rhizobium japonicum,* chlorosis-inducing strain (C) and normal strain (N) on soybean seedlings was studied at various dilutions. Both N and C extracts more concentrated than 1/50 were toxic to all soybean seedlings grown in them and little chlorosis developed. The toxic effects appeared to be due primarily to damage of the root system. Development of branch roots was inhibited, and the main root quickly developed a grayish-brown water-soaked appearance. Growth was retarded in 1/50 extracts, but slight chlorosis of the unifoliolate leaves and moderate chlorosis of the first trifoliolate leaves developed on seedlings grown

in C extract. Seedlings of highly susceptible Lee and those of slightly susceptible CNS were equally chlorotic in the 1/50 C extract. In contrast, chlorosis of Lee in 1/100 concentration was as severe as in the 1/50, but CNS was free of chlorosis. In some lots of C extract, Lee cultivar was as chlorotic in 1/200 as in 1/100 concentration; in other lots it developed no chlorosis at 1/200 and only moderate chlorosis at 1/100.

1003. JOHNSON, H. W., and U. M. MEANS. 1960. Interaction between genotypes of soybeans and genotypes of nodulating bacteria. Agron. J. 52:651–654.

Ninety-six of 188 cultivars tested of soybean developed chlorosis when inoculated with chlorosis-inducing strain 76 of *Rhizobium japonicum*. Data on the interaction of strains of the bacterium and genotype of soybean cultivars are presented. The implications of nonbeneficial interaction between genotypes of nodulating bacteria and host plant are discussed.

1004. JOHNSON, H. W. 1960. Registration of soybean varieties VII. Agron. J. 52:659–660.

Describes soybean cultivars as follows: Hill — resistant to bacterial pustule, wildfire, and frog-eye leaf spot; tolerant to Phytophthora rot; Hood — resistant to bacterial pustule, wildfire, frog-eye leaf spot, and target spot; Lindarina — resistant to frog-eye leaf spot and some races of downy mildew, moderately resistant to stem canker; Merit — resistant to Phytophthora rot; Shelby — resistant to frog-eye leaf spot.

1005. JOHNSON, H. W., and J. P. JONES. 1961. Other legumes prove susceptible to powdery mildew of *Psoralea tenax*. Plant Dis. Reptr. 45:542–543.

In the greenhouse Dorman soybeans became naturally infected by the powdery mildew fungus of *Psoralea tenax*. In pathogenicity tests, cultivars Arksoy, Dorman, Ogden, and Roanoke of soybean developed the symptoms of powdery mildew though the disease was more severe on Dorman than on the other cultivars. Illini and Mukden remained free of infection.

1006. JOHNSON, H. W., and J. P. JONES. 1962. Purple stain of guar. Phytopathology 52:269–272.

Cercospora kikuchii infects both guar and soybean. Isolates from both hosts are cross-infectious.

1007. JOHNSON, H. W., and B. L. KEELING. 1968. A *Phytophthora* from subterranean clover roots that attacks soybean and other legumes. Phytopathology 58: 1054. (Abstr.)

An abstract of entry 1008.

1008. JOHNSON, H. W., and B. L. KEELING. 1969. Pathogenicity of *Phytophthora megasperma* isolated from subterranean clover roots. Phytopathology 59: 1279–1283.

The fungus was pathogenic to Arksoy and Lee soybeans.

1009. JOHNSON, H. W., and B. L. KEELING. 1969. Pathogenicity of *Phytophthora parasitica* isolated from regal white clover roots. Plant Dis. Reptr. 53:446–450.

A species of *Phytophthora* was isolated from discolored roots of Regal white clover (*Trifolium repens*). The fungus did not form sexual organs in culture but was identified from the shape and size of its sporangia and chlamydospores, its temperature relations, and its pathogenicity as *P. parasitica*. D55-1492, D60-9647, Arksoy, and Lee soybean, Alaska garden pea (*Pisum sativum*), blue lupine (*Lupinus angustifolius*), yellow lupine (*L. luteus*), and Marglobe tomato (*Lycopersicon esculentum*) proved susceptible in varying degree when seedlings were inoculated. The fungus caused damping-off of seedlings of Arksoy soybean and Delta alfalfa (*Medicago sativa*) when seeds were planted in infested soil or sand. The fungus caused a rot of green tomatoes, mature apples, Irish potato tubers, and immature cotton bolls when these were inoculated.

1010. JOHNSON, J. 1916. Host plants of *Thielavia basicola*. J. Agr. Res. 7:289–300.

Soybean is included as a host.

1011. JOHNSON, J. 1922. The relation of air temperature to the mosaic disease of potatoes and other plants. Phytopathology 12:438–440.

Soybean mosaic is inhibited at temperatures of 26 to 28 C.

1012. JOHNSON, J. 1939. Studies on the nature of brown root rot of tobacco and other plants. J. Agr. Res. 58:843–863.

Soybean when grown in soil infested by tobacco brown root rot was susceptible to the disease.

1013. JOHNSON, J. 1942. Studies on the viroplasm hypothesis. J. Agr. Res. 64:443–454.

Soybean is susceptible to a new bean yellow necrosis virus by artificial inoculation.

1014. JOHNSTON, A. 1958. A note on fungicidal seed dressing of soyabean, groundnut, and long bean. Malayan Agr. J. 41:152–155.

Poor germination of soybean seed led to chemical seed treatment trials. Agrosan GN, mergamma B, spergon, fersan, flit 406, and tritoftoral were used in the form of dusts. All gave satisfactory results, the best being fersan which gave a 53% increase in germination.

1015. JOHNSTON, A. 1960. A preliminary plant disease survey in North Borneo. Plant Prod. and Prot. Div., Food and Agr. Org., Rome. 43 pp.

Purple seed stain (*Cercospora kikuchii*) infected pods and seed. Anthracnose (*Colletotrichum dematium* f. *truncata*) caused a black spotting of the pods, is seedborne and may cause poor germination and seedling

canker. Leaf spots were caused by *Mycosphaerella* sp. and *Phyllosticta glycines* (= *P. sojaecola*). Survey made in September 1959.

1016. JOHNSTON, A. 1960. A preliminary plant disease survey in Sarawak. Plant Prod. and Prot. Div., Food and Agr. Org., Rome. 17 pp.

Phakopsora pachyrhizi was found at Kuching-Serian Rd. during the survey of 12 September to 4 October 1959.

1017. JOHNSTON, A. 1960. A supplement to a host list of plant diseases in Malaya. Commonw. Mycol. Inst., Mycol. Papers 77. 30 pp.

Reports occurrence of leaf spot caused by *Choanephora cucurbitarum,* a leaf rot caused by *Corticium solani,* and a stem die-back caused by *Glomerella glycines.*

1018. JOHNSTON, A. 1961. A preliminary plant disease survey in Netherlands New Guinea. Netherlands New Guinea Dienst Econ. Zaken., Meded. Landbouwk. Ser. 1961 (4). 55 pp.

Occurrence of *Cercospora kikuchii* as the cause of a minor leaf spot disease affecting only old plants. This was the only disease reported on soybeans for Netherlands New Guinea.

1019. JONES, F. G. W. 1960. Observations on the beet eelworm and other cyst-forming species of *Heterodera.* Ann. Appl. Biol. 27:407–440.

1020. JONES, F. R., and J. H. TORRIE. 1946. Systemic infection of downy mildew in soybean and alfalfa. Phytopathology 36:1057–1059.

Planting of soybean seeds encrusted with oospores of *Peronospora manshurica* gave rise to seedlings with systemic infection. Cultivars of soybean differed in kind and abundance of lesions and production of oospore-encrusted seeds.

1021. JONES, J. P. 1958. Isolation of sporulating strains of *Cercospora kikuchii* by selective sub-culturing. Phytopathology 48:287–288.

A culture of *Cercospora kikuchii* isolated by spore transfer from a soybean stem was found to have two sporulating sectors, each about 4 mm in diameter. Portions of these sectors were transferred to fresh potato-dextrose agar in petri plates, which were then incubated at room temperature on a table exposed to daylight. The resulting colonies were examined daily until sporulating areas appeared (4–6 weeks after transfer), when small portions (about 2 × 2 mm) were transferred to fresh media, and the process was repeated through a series of seven subcultures. The final group of transfers was made 10 months after the first. About 20–25 portions of the sporulating sectors were transferred at each subculturing.

1022. JONES, J. P. 1959. Purple stain of soybean seeds incited by several *Cercospora* species. Phytopathology 49:430–432.

Eighteen isolates of *Cercospora* representing 13 species isolated from 13 separate host species were inoculated into attached developing soybean pods. Ten of the 13 *Cercospora* species incited purple-stained soybean seeds indistinguishable from those produced by *C. kikuchii,* the purple seed stain fungus of soybean. The purple discoloration was found to be due to presence of the fungi within the seed coats. The *Cercospora* isolates showed a correlation between the ability to incite purple stain of soybean seeds and the production of purple pigment in pure culture.

1023. JONES, J. P., and E. E. HARTWIG. 1959. A simplified method for field inoculation of soybeans with bacteria. Plant Dis. Reptr. 43:946.

Ten moderately infected leaflets are blended in a blender with 300–600 ml H_2O. After letting stand 1–2 hr., strain through two layers of cheesecloth, make up to 1 gal. and apply as spray. Minced, infected leaflets can be stored 12–14 months in capped jars at 0–20 F and used in the same way. (*Xanthomonas phaseoli* var. *sojense* and *Pseudomonas tabaci.*)

1024. JONES, J. P., and H. W. JOHNSON. 1960. Phytophthora root and stem rot of lupines. Phytopathology 50:641. (Abstr.)

Seedlings of the three cultivated species of lupine (*Lupinus angustifolius, L. luteus,* and *L. albus*) wilted and died when seeds were planted in pots of Sharkey clay obtained from a field at Stoneville, Miss. Soybean previously grown in this field had been attacked by Phytophthora root and stem rot. Oospores were found in roots and hypocotyl of infected lupine seedlings, and *P. megasperma* var. *sojae* was isolated from them by plating surface-sterilized tissue fragments on lima bean agar. When seedlings of the three lupine species and of three cultivars of soybean (Clark, Ogden, and Arksoy) were inoculated with an isolate of the fungus from *L. angustifolius* by puncturing the hypocotyl with a spear-headed needle dipped in inoculum, all but the resistant Arksoy wilted and collapsed within 4 days. Stem-puncture inoculations with a soybean isolate gave similar results. Infection was also obtained when seeds were planted in artificially infested sand and when the inoculum was poured over the seeds before covering. Seedlings of the following native species of lupine were susceptible when inoculated by the stem-puncture method: *Lupinus bicolor, L. densiflorus,* and *L. succulentus.*

1025. JONES, J. P. 1961. A weak host of *Xanthomonas phaseoli* var. *sojense.* Phytopathology 51:206.

Red vine (*Brunnichia cirrhosa* Gaertn) is natural host of the bacterium.

1026. JONES, J. P. 1968. Survival of *Cercospora kikuchii* on soybean stems in the field. Plant Dis. Reptr. 52:931–934.

The fungus *Cercospora kikuchii* was found to overwinter in infected soybean debris collected from a number of fields in the Yazoo-Mississippi delta area. When infected stems were placed on and under two types of soil in an overwintering field test, the fungus on the buried stems ceased within 2 months to sporulate, although it continued to do so abundantly on buried stems. Plowing under of soybean debris after harvest would eliminate this source of spring inoculum.

1027. JONES, J. P., and H. W. JOHNSON. 1969. Lupine, a new host for *Phytophthora megasperma* var. *sojae*. Phytopathology 59:504–507.

A *Phytophthora* sp. morphologically and pathogenically similar to *P. megasperma* var. *sojae* was isolated from three *Lupinus* spp. growing in naturally infested soil. In inoculation tests three native *Lupinus* spp. were also susceptible but none of the 16 other legumes or 9 nonlegumes was a host. It is suggested that the fungus may have been endemic on native lupines in the United States when soybean was first introduced.

1028. JONES, J. P. 1969. Reaction of *Lupinus* spp. to *Phytophthora megasperma* var. *sojae*. Plant Dis. Reptr. 53:907–909.

This report concerns an expanded study of the reaction of lupine species to the test fungus. Most species of *Lupinus* appear to be highly susceptible to stem inoculation with the test fungus.

1029. JOOSTE, W. J. 1969. Infection of crops by *Rhizoctonia bataticola* as influenced by soil moisture [French summary]. Phytophylactica 1:15–18.

Soybean was susceptible to the fungus under dry conditions.

1030. KACHALOVA, Z. P. 1962. Some results of the use of antisera of the experimental station for plant protection [in Russian, English summary]. Moscow Timiriazev. Sel'skokhoz. Akad. Izv. 1962, pp. 214–220.

In 1955 sera were obtained specific for *Pseudomonas sojae* (= *P. glycines*), *Xanthomonas phaseoli* var. *sojense*, and *X. glycines*. Serological tests of resistance to bacterioses in soybean cultivars were not always in agreement with field results. Also developed were sera specific for soybean mosaic virus.

1031. KAHN, R. P., and F. M. LATTERELL. 1955. Symptoms of bud blight of soybeans caused by tobacco- and tomato-ringspot viruses. Phytopathology 45:500–502.

Soybean plants infected with the tobacco ringspot virus may be characterized by several important symptoms that apparently have not been reported in the literature. These include (1) stunting, (2) proliferation of floral buds and abortion of pods, (3) proliferation of trifoliolate leaves, (4) abnormally dark-green leaves, and (5) swollen nodes. The tomato ringspot virus induced typical bud blight symptoms in greenhouse- and field-grown soybean plants. This is believed to be the first report of this virus as a causal agent of soybean bud blight.

1032. KAHN, R. P. 1956. Seed transmission of the tomato ringspot virus in the Lincoln variety of soybeans. Phytopathology 46:295.

Tomato ringspot virus induces symptoms similar to tobacco ringspot virus when inoculated on soybean cultivar Lincoln. The tomato ringspot virus is seed transmitted in soybean. Planting of infected seed produced plants with symptoms typical of bud blight.

1033. KAHN, R. P., and H. A. SCOTT. 1962. A new strain of tobacco ringspot virus isolated from an unidentified imported species of *Eucharis*. Phytopathology 52: 16. (Abstr.)

A new strain of the tobacco ringspot virus (TRSV) was intercepted in an importation of a nonidentified species of *Eucharis* from Peru. The new strain differed from other strains or isolates in that it was almost always latent in Samsun and seven other tobacco cultivars inoculated with it. The virus was seedborne in soybean and *Gomphrena globosa*, but the seedlings were usually symptomless. Antisera with titers of 1:256 and 1:512 were prepared when the virus was extracted with a 1:1:1 chloroform-butanol-phosphate buffer mixture from *G. globosa* or symptomless Samsun tobacco, subjected to two cycles of alternate low- and high-speed centrifugation, mixed with Freund's incomplete adjuvant, and injected intramuscularly into rabbits. Microprecipitin and Ouchterlony double-diffusion agar tests indicated that the new strain is related serologically to the Steere (AC 174), Price (AC 98), and soybean bud blight isolates of TRSV. The new strain is not related to tomato ringspot virus. The thermal inactivation point is 65 C, the dilution end point is in excess of 1:25,000, and the longevity at room temperature is 6–8 days.

1034. KALASHNIKOV, K. Y. 1970. Diseases of germinating seeds under conditions of low temperatures [in Russian]. Mikol. i Fitopatol. 4:235–238.

Germination of *Penicillium*-infected soybean seeds was reduced at temperatures lower than 10–12 C. Seed treatment with granosan and thiram increased germination and decreased disease incidence.

1035. KALTON, R. R., and J. C. ELDREDGE. 1946. The effect of simulated hail injury. Soybean Dig. 6(3): 14–15.

Effects of the damage simulating hail injury on soybean were tested by artificially removing leaves and parts of stems. Reductions in yield varied with the degree of

damage and, for any one degree of damage, with the stage of plant development. Time of maturity and plant height were affected at earlier stages of development, while seed quality, oil content, and iodine number were most significantly affected when the damage was inflicted during and after pod formation.

1036. KALTON, R. R., C. R. WEBER, and J. C. ELDREDGE. 1949. The effect of injury simulating hail damage to soybeans. Iowa Agr. Expt. Sta. Res. Bull. 359, pp. 736–796.

Damages simulating light, medium, and heavy hail injuries were inflicted by clipping and beating on soybeans in different stages of development. Yields were most reduced when the damage was inflicted as seed development began in the lower pods, and were least reduced when plants were 6–12 in. tall with 2–5 trifoliolate leaves unrolled. Injuries before and during blooming delayed maturity, while injury after the "green bean" stage hastened maturity. Medium and heavy damages during seed development lowered seed quality and reduced seed size.

1037. KAMAL, M., and M. K. ABO-EL DAHAB. 1968. Occurrence of brown stem rot of soybean in Egypt. Phytopath. Medit. 7:28–33. [Duplicate of entry 2.]

Cephalosporium gregatum, the causal agent of brown stem rot disease of soybean, was isolated in this work for the first time in Egypt (U.A.R.) from diseased soybean stems and seeds that developed on diseased plants. The fungus isolates were of the sporulating type since the presence or absence of sugars in the tested media did not affect conidia production. On potato-dextrose, soybean-stem or soybean-seed agar media, conidia produced by the isolate obtained from diseased stems measured μ 3.4–6.9 $\times$ 1.6–2.9. Those produced by the isolate obtained from seeds measured μ 4.2–7.2 $\times$ 1.8–3.6. Conidia produced inside infected stems of the host measured μ 4.8–7.4 $\times$ 1.9–3.4 and were not typically larger than those developed in pure culture. The ability of the isolated fungus to infect soybean and not corn plants, with production of the characteristic browning of internal stem tissues, has confirmed the identity of the fungus as being *C. gregatum* and not a strain or a variant of the related species *C. acremonium* Cda.

1038. KATEVA, O. 1932. Diseases of soy [in Russian]. *In* [Summary account of mountain zonal maize-soy-potato expt. sta. for 1931. Part III. Department of phytopathology. Diseases of maize and soy under conditions of North Caucasus. Nauchn.] Trudy Gorskaia Zonal. Kukur-Soevo-Kartof. Opytn Stan. Ser. 1. 4:79–101.

Twenty-two fungi and bacteria were found on soybean. Descriptions of symptoms and causes are given, with illustrations, for the following diseases: seedling blight caused by *Fusarium* sp., Fusarium wilt, a stem disease caused by *Gibberella* sp., bacterial blight, bacterial pustule, Phyllosticta leaf spot, stem breaking caused by *Fusarium* sp., downy mildew, sclerotiniosis, and mosaic. Methods of prevention and control are briefly described.

1039. KATSUFUJI, K. 1919. Yellow dwarf, a new nematode disease of soybean [in Japanese]. Ann. Phytopath. Soc. Japan 1:12–16.

The symptoms of yellow dwarf disease are described and the pathogen is identified as *Heterodera schachtii.*

1040. KAUFFMAN, P. H., and C. LEBEN. 1974. Soybean bacterial blight: flower inoculation studies. Phytopathology 64:329–331.

Soybean flowers were inoculated with *Pseudomonas glycinea* and the resulting pods were surface-sterilized, opened, and assayed in vitro for the pathogen. With greenhouse and field inoculations, *P. glycinea* was detected in the interior of 15% of the pods, usually at the proximal end. In field tests the pathogen was not associated with seeds in infected pods, but in the greenhouse it was associated with seeds in 25% of these pods. Other types of bacteria were isolated from within the pods of inoculated and control plants. Pod set was not reduced by flower inoculation.

1041. KAUFMANN, M. J., and J. W. GERDEMANN. 1957. Root and stem rot of soybean caused by a species of *Phytophthora.* Phytopathology 47:19. (Abstr.)

An abstract of entry 1042.

1042. KAUFMANN, M. J., and J. W. GERDEMANN. 1958. Root and stem rot of soybean caused by *Phytophthora sojae* n.sp. Phytopathology 48:201–208.

An undescribed species of *Phytophthora* was found associated with root and stem rot of soybeans in Illinois. Comparative studies indicated that Illinois isolates were identical with isolates obtained by other investigators from similarly diseased soybeans in Ohio and North Carolina. This pathogen causes preemergence and postemergence damping-off and a root and stem rot of plants at all stages of maturity. In Illinois, stem rot is the most conspicuous symptom. A comparison of eight inoculation techniques revealed that two gave quick reliable results. These were (1) inoculation by introduction of infested whole oats into the soil at time of planting and (2) insertion of bits of mycelium into seedling hypocotyls. Both methods gave nearly 100% infection in susceptible cultivars whereas little or no disease developed in resistant cultivars. Comparable checks remained healthy. The pathogen also caused a damping-off of alfalfa and sweet clover seedlings. This fungus appears distinct from previously described species of *Phytophthora* and the name *Phytophthora sojae* n.sp. is proposed. It differed in morphology, pathogenicity, growth rate, and staining reaction from the two closely related species, *P. cactorum* and *P. megasperma.*

1043. KAUFMANN, M. J., and D. W. CHAMBER-

LAIN. 1957. The effect of antibiotics on *Pseudomonas glycinea.* Plant Dis. Reptr. 41:806–807.

Laboratory assays employing the paper-disk plate method demonstrated that 10 ppm of aureomycin, achromycin, and tetracycline inhibited the multiplication of *Pseudomonas glycinea.* Streptomycin was moderately effective at 100 ppm. In field tests, only streptomycin at 250 ppm gave satisfactory control of bacterial blight, but induced varying amounts of leaf chlorosis. The addition of $MnSO_4$ to the antibiotic solution prevented the leaf chlorosis but occasionally caused a "scorching" of the leaves. Since the chlorosis appears to do little or no damage, the risk involved in controlling it with Mn is not considered justified.

1044. KAWASE, Y. 1955. On the resistance of *Pellicularia rolfsii* causing sclerotial blight of soybean to mercuric chloride [in Japanese, English summary]. Osaka Pref. Univ. Bull. Ser. B 5:167–174.

When the fungus (= *Sclerotium rolfsii*) is cultured by the use of sclerotium as inoculum repeatedly on medium containing 10^{-4} mol $HgCl_2$, its growth becomes inferior to the original strain in the first generation, but in the fourth generation it begins to grow better than the latter and becomes so resistant as to be able to grow on medium containing 10^{-3} mol $HgCl_2$. Also in the eighth generation the fungus grows in the same degree with the fourth generation, but such acquired resistance is instantly lost by one return to a nonmercuric chloride medium. This strain is also resistant to $HgNO_3$, $CuSO_4$, and $CuCl_2$, and its growth is better than the original strain. Its pathogenic intensity on soybean is almost the same as the original.

1045. KAWATSUKA, K. 1920. Bacterial disease of soybean [in Japanese]. J. Plant Prot. (Tokyo) 7:220–221.

1046. KEELING, B. L. 1972. Studies on the nature of soybean resistance to seed rot caused by *Pythium.* Phytopathology 62:768. (Abstr.)

An abstract of entry 1047.

1047. KEELING, B. L. 1974. Soybean seed rot and the relation of seed exudate to host susceptibility. Phytopathology 64:1445–1447.

Preemergence seed and seedling rot of soybeans in the Mississippi Valley area of Arkansas and Mississippi was determined to be caused primarily by *Pythium ultimum* and *P. debaryanum.* More than twice the quantity of soluble carbohydrate exuded from seed of the susceptible cultivar Hood than from the resistant cultivar Semmes. A third cultivar Lee was intermediate, both in amount of carbohydrate in its seed exudate and in the amount of seed rot. No qualitative differences were detected in exudates from seed of resistant and susceptible cultivars. A direct relationship between amount of soluble carbohydrate exuded by a germinating seed and seed rot caused by *Pythium* spp. was shown in these studies.

1048. KEEN, N. T. 1971. Hydroxyphaseollin production by soybeans resistant and susceptible to *Phytophthora megasperma* var. *sojae.* Physiol. Plant Path. 1: 265–275.

In compatible host-parasite combinations, levels of hydroxyphaseollin were X100-44 the ED_{50} conc. for inhibiting mycelial growth of the pathogen, while in compatible combinations the level was only X1-4 the ED_{50}. Hydroxyphaseollin was not present in noninoculated soybean hypocotyls and did not begin to accumulate until 10–12 hr. after inoculation. Both susceptible and resistant hypocotyls were more resistant with age and accumulated more hydroxyphaseollin. The resistance conferred by the Rps allele was broken by heat treatment, which also reduced the amount of hydroxyphaseollin by 90%. It is concluded that hydroxyphaseollin is the phytoalexin produced by soybeans with genetically defined resistance to *Phytophthora megasperma* var. *sojae.*

1049. KEEN, N. T., J. J. SIMS, D. C. ERWIN, E. RICE, and J. E. PARTRIDGE. 1971. 6a-hydroxyphaseollin: an antifungal chemical induced in soybean hypocotyls by *Phytophthora megasperma* var. *sojae.* Phytopathology 61:1084–1089.

A new hydroxypterocarpan, 6a-hydroxyphaseollin (HP), was isolated from soybean hypocotyls challenged with *Phytophthora megasperma* var. *sojae.* Hydroxyphaseollin was the only induced antifungal compound detected in bioassays of hypocotyl extracts from challenged plants. A gas-liquid chromatographic analysis was devised for HP which showed that it accumulated in about 10-fold higher concentrations in inoculated hypocotyls of monogenically resistant soybeans than in a near-isogenic susceptible line.

1050. KEEN, N. T., and R. HORSCH. 1972. Hydroxyphaseollin production by various soybean tissues: a warning against use of "unnatural" host parasite systems. Phytopathology 62:439–442.

Confirming previous reports, rates of production of the antifungal pterocarpan 6a-hydroxyphaseollin (HP) were greater in inoculated hypocotyls of Harosoy 63 soybeans (monogenically resistant to *Phytophthora megasperma* var. *sojae*) than in the near-isogenic susceptible cultivar Harosoy. Hydroxyphaseollin was also produced by soybean roots, cotyledons, pods, and tissue culture callus when inoculated with *P. megasperma* var. *sojae,* but rates of production by these tissues were similar in the two cultivars. The data further implicated HP with the *Phytophthora* resistance of Harosoy 63 soybeans, since accelerated production in this cultivar relative to Harosoy was only observed in hypocotyls, the organ in which resistance is expressed naturally. Our data therefore warn against the use of "unnatural" plant tissues such as pods

and tissue culture callus in investigation concerned with the elucidation of naturally occurring disease resistance mechanism in plants.

1051. KEEN, N. T. 1972. Accumulation of wyerone in broadbean and demethylhomopterocarpan in jack bean after inoculation with *Phytophthora megasperma* var. *sojae*. Phytopathology 62:1365–1366.

Extracts from broad bean and jack bean hypocotyls inoculated with the nonpathogen, *Phytophthora* var. *sojae* contained antifungal compounds not detected in extracts from noninoculated plants. The induced antifungal compounds have been identified as wyerone from broad bean and demethylhomopterocarpan from jack bean.

1052. KEEN, N. T. 1973. Use of germinating seeds for producing large amounts of phytoalexins. 2nd Internatl. Cong. Plant Path. Abstrs.: 0768.

A major technical difficulty in the study of inducible antifungal compounds (phytoalexins) in higher plants is the isolation of purified compounds in amounts sufficient for chemical characterization. We found that germinating seeds challenged with the natural microflora or a nonpathogenic fungus are a ready source of phytoalexins in large amounts. Imbibed seeds were chopped into small pieces with a razor blade and placed in petri dishes directly with H_2O or with a mycelial suspension of *Pms.* The plates were incubated at 25 C for 2–5 days and extracted. The extracts were bioassayed by thin layer chromatography (TLC) or germ tube elongation methods and antifungal compounds were isolated by preparative TLC. Seeds of green pea, soybean, cowpea, jack bean, and garbanzo bean produced the same phytoalexins (pisatin, hydroxyphaseollin, kievitone, medicarpin, and medicarpin + maackiain, respectively) as hypocotyls of the same plants challenged with *Pms.* Control seeds which had been killed by freezing did not produce the compounds. The low levels of pigments in the seed extracts facilitated purification of the compounds in 10–30 mg amounts. The seed technique may have applicability to the search for phytoalexins in other plants.

1053. KEEN, N. T. 1973. Relation of hydroxyphaseollin and related isoflavanoids to the hypersensitive resistant reaction of soybeans to *Pseudomonas glycinea*. 2nd Internatl. Cong. Plant Path. Abstrs.: 0653.

Large quantities of the isoflavanoids 6a-hydroxyphaseollin (HP), coumestrol, daidzein, and sojagol were produced in soybean leaves undergoing the hypersensitive resistant response (HR) to incompatible races of *Pseudomonas glycinea*. Leaves similarly inoculated with compatible races accumulated the isoflavanoids at 0.01–0.1 this rate. Visible hypersensitive necrosis and isoflavanoid accumulation did not occur when 0.1 or less the standard density ($1\text{–}5 \times 10^6$ cells/ml) of incompatible cells was introduced into leaves. However, the "protective" response found in tobacco did not occur in soybeans; infiltration of the standard concentration of incompatible cells into leaves previously inoculated with 0.1 the standard concentration of compatible or incompatible cells resulted in a typical HR and isoflavanoid accumulation occurred. Electrolyte leakage in leaves inoculated with standard concentrations of incompatible *P. glycinea* races was only 10% greater than that of the noninoculated controls, but a 10-fold permeability increase accompanied the appearance of susceptible symptoms on leaves inoculated with compatible races. Hydroxyphaseollin at 20 ppm affected growth and at 100 ppm completely inhibited colony formation by three *P. glycinea* races on Kado's D medium while concentrations of HP in excess of 1,000 ppm were attained in soybean leaves undergoing the HR.

1054. KEEN, N. T., and B. W. KENNEDY. 1974. Hydroxyphaseollin and related isoflavanoids in hypersensitive resistance reaction of soybean to *Pseudomonas glycinea*. Physiol. Plant Path. 4:173–185.

The hypersensitive reaction (HR) of soybean leaves to incompatible races of *Pseudomonas glycinea* was typified by rapid accumulation of the isoflavanoid compounds hydroxyphaseollin, coumestrol, daidzein, and sojagol. The same compounds accumulated in response to inoculation with the nonpathogen *P. lachrymans*. In contrast, compatible races of *P. glycinea* led to delayed appearance of the isoflavanoids and the levels attained were 10% or less of those in resistant leaves. Accumulation of the isoflavanoids in resistant leaves was chronologically related to the restriction of bacterial multiplication. Cyclic-3′,5′-adenosine monophosphate at pH 8 caused both the HR and isoflavanoid accumulation when supplied to leaves with normally compatible *P. glycinea* races. Hydroxyphaseollin possessed antibacterial properties in vitro at 25–100 parts/10^6, concentrations that are less than 10% of those occurring in resistant soybean leaves. Coumestrol also inhibited colony development by *P. glycinea* in bioassays. Pronounced electrolyte loss did not occur in incompatible *P. glycinea*-soybean combinations, but was observed at the time of symptom appearance in leaves inoculated with compatible races. The data indicated that the HR of soybean leaves to *P. glycinea* was not related to permeability alteration but instead to the inducible accumulation of isoflavanoids.

1055. KENDRICK, J. B., and M. W. GARDNER. 1921. Seed transmission of soybean bacterial blight. Phytopathology 11:340–342.

Bacterial blight pathogen *Bacterium glycineum* (= *Pseudomonas glycinea*) is transmitted with seeds from diseased pods.

1056. KENDRICK, J. B., and M. W. GARDNER. 1924. Soybean mosaic: seed transmission and effect on yield. J. Agr. Res. 27:91–98.

Soybean mosaic is transmitted by the seed, usually in

rather low percentage varying with cultivars. There is no relation between seed transmission and location of pods or time of infection. The virus survives for at least 2 years in the seed. A conspicuous brown mottling of the seed coat has not been correlated with mosaic. Planting infected seeds produces plants showing mosaic symptoms. Selecting seeds from healthy plants as a control measure has proved effective. Mosaic had little influence on germination power of seeds but caused a loss of 30–75% in yield. No other host of the virus is found.

1057. KENNEDY, B. W. 1964. Moisture content, mold invasion, and seed viability of stored soybeans. Phytopathology 54:771–774.

The predominant fungi in Minnesota soybean seeds collected 3–5 months after harvest include species of *Alternaria, Fusarium, Aspergillus,* and *Penicillium.* Fungi were isolated from 15% of seed in 23 samples collected in 1961 and from 12% of seeds in 11 samples collected in 1962. *A. glaucus* was isolated from 68% of seeds stored 10 months or longer. This group was able to persist for at least 11 months in seeds stored at 6.5% moisture, whereas 4 other genera decreased and *A. niger* disappeared completely. Soybean seeds with 6–7% moisture content reached 20% moisture content four times as fast in moving air of 90% relative humidity as in still air of 93% relative humidity.

1058. KENNEDY, B. W. 1965. Tolerance of *Pseudomonas glycinea* to freezing. Phytopathology 55:415–417.

Freezing at 15 C did not alter pathogenicity of *Pseudomonas glycinea.* Survival of the bacteria was greater if the bacteria were frozen while in infected leaves of soybeans than if they were suspended in solution of glycerol, ethylene glycol, lactose, or glucose. Survival in frozen leaves over a period of 6 months was enhanced by submerging infected leaves in water before freezing.

1059. KENNEDY, B. W., and J. E. CROSS. 1966. Inoculation procedures for comparing reactions of soybeans to bacterial blight. Plant Dis. Reptr. 50:560–565.

The most efficient and precise of 16 methods tested for determining pathogenic races of the soybean bacterial blight pathogen, *Pseudomonas glycinea,* was one in which the Paasche Airbrush (artist's paint-sprayer) was used to water-soak leaves. Several factors, often difficult to control with precision, were important in obtaining uniform and repeatable disease reactions. Resistant plants could not be made truly susceptible merely by increasing the inoculum load, and resistance could almost always be associated with a lack of water-soaking symptoms and a quick browning, blackening, or reddening of leaf mesophyll tissue or veins.

1060. KENNEDY, B. W., and R. L. COOPER. 1967. Association of virus infection with mottling of soybean seed coats. Phytopathology 57:35–37.

Mottling of the seed coats of soybeans was induced by inoculation of plants with a virus resembling soybean mosaic virus. The cultivar Merit, resistant to mottling, developed typical symptoms of mosaic when inoculated with the virus, but did not transmit the virus through the seeds. It was demonstrated that prevalence of mottling at St. Paul, Minn., was due to a high frequency of natural virus infection, and that lack of mottling at Lamberton, Minn., was due to absence of the virus.

1061. KENNEDY, B. W. 1969. Prevalence and detection of lipolytic microorganisms in soybean seeds. Cereal Chem. 46:70–73.

In at least one of several in vitro tests made, virtually all microorganisms isolated from various lots of stored soybean seeds indicated an ability to alter fatty substrates. This ability of a given microorganism could be dramatically affected by any of several factors, including competition from nearby colonies, submersion in the agar medium, and constitution of the growth medium and (or) choice of indicators used for detection of lipolytic activity. The addition of NaCl, useful for adjusting osmotic concentration to allow growth of important xerophytic fungi invading soybean seeds at certain moisture-temperature levels, could also change ability of organisms to produce a positive test for lipolysis. It was not possible to screen for lipolytic microorganisms by use of any single method.

1062. KENNEDY, B. W. 1969. Detection and distribution of *Pseudomonas glycinea* in soybean. Phytopathology 59:1618–1619.

The soybean host selects out small populations of *Pseudomonas glycinea* when the pathogen is present with saprophytes in seeds, stems, petioles, and debris in the soil. By use of such an in vivo test, where aqueous extracts from specimens were placed into healthy leaves, it was determined that the organism is widespread in commercial seed lots, and resides internally in field-grown plants. Indications are that it can survive from one season to the next in late-season leaves stored aboveground.

1063. KENNEDY, B. W., and T. W. MEW. 1971. Relationship of postinoculation humidity to bacterial leaf blight development on soybean. Phytopathology 61:879–880.

Conditions on sand benches in the greenhouse were favorable for severe bacteria leaf blight development on potted plants. Blight was consistently less severe on plants subjected to high humidity in growth chambers, lighted or nonlighted humidity chambers or plastic bags.

1064. KENNEDY, B. W., T. W. MEW, and L. OLSON. 1972. Reaction of soybean tissue cultivar to pathogenic and saprophytic bacteria. *In* H. P. Maas Gegteranus (ed.), Proceedings 3rd Internatl. Conf. Plant Path. Bacteria, Wageningen, April 1971.

Callus tissues of 5 soybean cultivars were inoculated with a total of 57 isolates of bacteria representing 26 species. Based upon either a color or a population standard, it could not be shown with certainty that callus distinguished between saprophytic and plant pathogenic bacteria. Death of callus by freezing or heat resulted in indiscriminate invasion by a wide variety of bacteria and a general absence of characteristic color changes. Reaction of callus tissues to bacteria was not easily changed via manipulation of physical and chemical environment where callus was grown.

1065. KENNEDY, B. W., J. LAURENCE, and J. VENETTE. 1973. Effects of moisture-temperature regimes on survival of bacterial pathogens in bean seeds during storage. 2nd Internatl. Cong. Plant Path. Abstrs.: 0813.

Naturally infected soybean seeds were subjected to a variety of temperature-moisture combinations and then assayed for viability, vigor, and seed transmission of bacterial blight to seedlings. Bioassays were made by noting symptoms development either on healthy seedling leaves inoculated with aqueous extracts from samples or on seedlings from samples planted in the field. Numbers of bacteria, seedling emergence, and seedling vigor declined when seeds were stored at higher moisture and (or) temperatures than those occurring normally in the laboratory. Although death of bacteria was more rapid than death of seeds, germination was reduced to 50% or more by the time bacteria declined to a point where they could no longer be detected in the greenhouse bioassay on leaves. When such samples were planted in the field, emergence was no more than 5% and seedlings were not blight-free.

1066. KENNEDY, B. W., and H. TACHIBANA. 1973. Bacterial diseases. *In* B. E. Caldwell (ed.), Soybeans: improvement, production and uses, pp. 491–504. Amer. Soc. Agron., Madison, Wis.

Brief description of symptoms, pathogens, and control measures of bacterial blight (*Pseudomonas glycinea*), bacterial pustule (*Xanthomonas phaseoli* var. *sojense*), wildfire (*P. tabaci*), wilts caused by *Corynebacterium flaccumfaciens* and *P. solanacearum*.

1067. KENNEDY, J. S., M. F. DAY, and V. F. EASTOP. 1962. A conspectus of aphids as vectors of plant viruses. Commonw. Inst. Ent., London. 114 pp.

A compilation from the literature (443 references) up to the end of 1960 and an extension of the aphid section of an earlier compilation. A review of problems of specificity in arthropod vectors of plant and animal viruses. Viruses are listed according to original host name of the virus. No other hosts are listed.

1068. KENT, G. C. 1942. Soybean diseases in Iowa. Plant Dis. Reptr. 26:359.

Records the prevalence of root necrosis caused by *Pythium* spp. and *Rhizoctonia,* bacterial blight, and mosaic.

1069. KENT, G. C. 1945. A study of soybean diseases and their control. Iowa Agr. Expt. Sta. Rpt. on Agr. Res. for the year ending June 30, 1945. Part I, pp. 221–222.

Increase in stand by seed treatment was obtained only in one case with new improved ceresan at ½ oz./bu. There was no evidence of destruction of nodule bacteria by seed treatment, except that no nodules were found on the main root of plants from seed treated with organic mercurial fungicide. The bacteria causing bacterial pustule and bacterial blight were found to be widely distributed on the surface of beans from infected plants. Both organisms were destroyed at 10 F in 7 weeks in culture solution, but withstood 13 weeks at the same temperature when dispersed in steamed soil.

1070. KEOGH, R. 1974. *Phakopsora pachyrhizi* Syd: the causal agent of soybean rust. Australian Plant Path. Soc. Newsltr. 3:5. (Abstr.)

In Australia *Phakopsora pachyrhizi* has been known in restricted areas of Queensland but now has spread in vicinity of major soybean-growing areas of New South Wales and Queensland Darling Downs. Host range includes *Glycine wightii, Phaseolus lathyroides, P. vulgaris, G. javanica, G. clandistina, G. tachibana, G. tomentella, Lupinus angustifolius, Lespedeza junica, Kennedia rubicunda, K. coccina,* and *Canavalia maritima.* Pustules occurred on soybeans on leaves, petioles, and finer stem parts. Uredospores of this hemicyclic rust germinate well at 18–25 C, but not above 32 C or below 8 C. Germination is restricted by high light intensity.

1071. KERNKAMP, M. F. 1948. Could soybean seed be treated? Minnesota Farm and Home Sci. 5(3):5.

A popular article. Seed treatment with spergon followed by inoculation with nodule bacteria does not affect nodulation. Nodulation was good even where no inoculum was applied.

1072. KERNKAMP, M. F. 1948. Root rots of soybeans. Soybean Dig. 9(11):54–55.

Rhizoctonia solani is considered potentially the most destructive pathogen of soybean in Minnesota. Trials on its control are in progress in relation to crop rotation, seed treatment, and breeding.

1073. KERNKAMP, M. F. 1948. Chemical treatment of soybean seed in relation to nodulation by nodule bacteria. Phytopathology 38:955–959.

Application of spergon with commercial Nitragin did not influence nodulation by *Rhizobium leguminosarum* when soybean seeds were planted in soil already containing the bacteria, but did reduce nodulation in steamed soil. Time of application of inoculant or fungicide appeared unimportant, although slightly more nodu-

lation resulted when the inoculant was applied after the spergon.

1074. KERNKAMP, M. F., and J. W. GIBLER. 1951. Resistance in soybeans to root rot caused by *Rhizoctonia solani.* Phytopathology 41:21. (Abstr.)

All cultivars of soybeans recommended in Minnesota are susceptible to root rot caused by *Rhizoctonia solani,* but recent investigations indicate that resistance to this disease is available by reselection within certain cultivars or strains from hybrid origin. In routine tests of breeding material for resistance to *R. solani* some plants survived. Progenies of these plants were reselected in two subsequent field trials and were tested for resistance in three greenhouse trials. In each trial they were planted in soil artificially infested with five virulent races of *R. solani.* Twelve lines with a high degree of resistance resulted from this reselection: five from (Lincoln × Richland) × Lincoln; two from Mandarin × Richland; one from Mukden × Linman 533; one from Mukden × Wisconsin Manchu 3; one from Mukden × Richland; one from Ottawa Mandarin; and one from Flambeau.

1075. KERNKAMP, M. F., and J. W. GIBLER. 1951. Diseases of soybeans new to Minnesota. Plant Dis. Reptr. 35:509–510.

Report of first occurrence of *Cephalosporium gregatum* (= *Philophthora gregata*) and of *Diaporthe phaseolorum* var. *batatatis* (= *D. p.* var. *caulivora*).

1076. KHAN, A. M. 1950. Temperature and the development of *Rhizoctonia solani* on legumes. Phytopathology 40:14. (Abstr.)

Pathogenicity of two races, CT1C and CP1, of *Rhizoctonia solani* on two legumes, soybean and *Pisum sativum,* varied with soil temperature and with host. Race CT1C, originally isolated from soybean, killed 40% of the soybean and pea plants at low (14–17 C) and high (28–32 C) temperatures, while at intermediate temperatures only 20–30% of the plants were killed. Virulence of race CP1, originally isolated from flax, was similar to that of race CT1C when the soybean host was used. On the pea host, on the other hand, CP1 killed 18% of the plants at low temperatures and mortality increased gradually with temperature until finally at high temperatures it was 40%. Similar results were obtained in field tests. CT1C and CP1 have an optimum growth in culture at 24 C and 18 C respectively. Thus there seems to be no correlation between pathogenicity on these legumes and optimum temperatures for growth in culture.

1077. KHAN, A. M. 1954. The pH and pathogenicity of *Rhizoctonia* on soybeans and peas. Proc. Indian Sci. Cong. Assoc. (IV: Late Abstrs.) 41:30. (Abstr.)

The race of *Rhizoctonia solani* Kühn studied showed optimum growth at pH 6–7. In pathogenicity tests under controlled conditions, the same race was highly pathogenic to soybeans at pH 4–6. Since the soil lacked Ca and Mg, the high mortality rate was attributed to mineral deficiency rather than to difference in pH level.

1078. KHARE, M. K., H. C. SHARMA, S. N. KULKARNI, and T. N. CHAND. 1971. Bacterial pustule of soybeans (*Glycine max* (L.) Merr.) — varietal resistance under field conditions. Mysore J. Agr. Sci. 5:123–126.

Of the leaf diseases of soybean in India, *Xanthomonas phaseoli* var. *sojense* is the most destructive. The reactions of 35 cultivars under natural conditions are given. Nine were resistant.

1079. KHU, T. 1958. Immunological characteristics of the causal organism of soybean bacteriosis [in Russian]. Moskov. Ordena Lenina Sel'skokhoz. Akad. im K.A. Timiriazeva, Dok. 39:230–237.

Describes the use of antigens in identification of bacteria on soybeans. Those studied were *Bacterium* sp., *Pseudomonas sojae* (= *P. glycinea*), *Xanthomonas glycines,* and *X. phaseoli* var. *sojense.*

1080. KIESSELBACH, T. A. 1943. Crop response to hormone seed treatments. J. Amer. Soc. Agron. 35:321–331.

No benefits were derived from hormone treatment of soybean seeds.

1081. KIKUCHI, R. 1924. On a disease of the soybean caused by *Cercosporina.* Utsunomiya Agr. Coll. Bull. 1, pp. 1–19.

A purple-spot disease, caused by *Cercosporina* sp., was found on soybean seeds in Japan. The morphology of the fungus is described.

1082. KILPATRICK, R. A., and H. W. JOHNSON. 1953. Fungi isolated from soybean plants at Stoneville, Mississippi, in 1951–1952. Plant Dis. Reptr. 37:98–100.

Fungi most frequently isolated (in order of prevalence) from vegetative parts of the plant were: *Alternaria* spp., *Cladosporium* spp., *Phomopsis sojae, Fusarium oxysporum, Cercospora* spp., *Colletotrichum* spp., *Corynespora cassiicola, Curvularia* spp., *Phyllosticta* spp., *Rhizoctonia solani, Sclerotium bataticola, S. rolfsii, Rhizopus nigricans, Aspergillus niger, Aspergillus* sp., *Cercospora sojina, Dendryphium* sp., *Fusarium roseum, F. solani, Helminthosporium* sp., and a number of nonidentified species. It is interesting to note that *S. bataticola* and *P. sojae* were isolated from soybean leaves, as well as from the other parts of the plant where they occur more commonly. Of the fungi isolated from soybean stems, the following were obtained from material that overwintered out-of-doors: *Cercospora* spp., *Colletotrichum* spp., *Corynespora cassiicola, Curvularia* spp., *Dendryphium* sp., and *Fusarium oxysporum.*

Fungi isolated from reproductive parts of soybean plants (in order of prevalence) were: *Alternaria* spp., *Clado-*

sporium spp., *Aspergillus* spp., *Cercospora* spp., *Fusarium oxysporum, Phomopsis sojae, Aspergillus niger, Curvularia* spp., *Penicillium* spp., *Phyllosticta* spp., *Corynespora cassiicola, Rhizopus nigricans, Cercospora sojina, C. kikuchii, Chaetomium* spp., *Fusarium roseum, F. solani, Nigrospora* spp., *Rhizoctonia solani, Trichoderma* spp., and several nonidentified species. Of fungi isolated from soybean seeds, two (*Cercospora sojina* and *Corynespora cassiicola*) were isolated from threshed seed only; six (*Chaetomium* spp., *Fusarium roseum, F. solani, Nigrospora* spp., *Rhizopus nigricans,* and *Trichoderma* spp.) were isolated only from seed still within the pods; while the remaining species were isolated from both types of seeds.

1083. KILPATRICK, R. A. 1955. Soybean diseases in the delta area of Mississippi in 1954. Plant Dis. Reptr. 39:578–579.

Reports the occurrence and prevalence of *Alternaria* spp., *Phyllosticta* spp., *Macrophomina phaseoli* (= *M. phaseolina*), *Cercospora kikuchii, Peronospora manshurica, Xanthomonas phaseoli* var. *sojense, Pseudomonas glycinea, Sclerotium rolfsii,* and *Diaporthe phaseolorum* var. *sojae.*

1084. KILPATRICK, R. A., and E. E. HARTWIG. 1955. Effect of planting date on incidence of fungus infection of Ogden soybean seeds grown at Walnut Hill, Florida. Plant Dis. Reptr. 39:174–176.

Ogden soybean seeds were obtained from a date-of-planting study grown at Walnut Hill, Fla., in 1952 and 1953. Counts of seed from each date of planting showed the visible purple stain to be more prevalent in 1952 than in 1953. Early planted plots in 1952 showed more purple stain than later planted ones. Isolations from apparently healthy soybean seed yielded 13 different fungi. The purple seed stain fungus, *Cercospora kikuchii,* and *Phomopsis sojae* were most frequently isolated. *C. kikuchii* was more commonly isolated from seed of early plants in 1952 and later plantings in 1953. *P. sojae* was isolated most frequently from seed of early plantings and only rarely from seed of late plantings in both years. Other fungi isolated were *Colletotrichum truncatum, Aspergillus* spp., *A. niger, Penicillium* spp., *Cladosporium* spp., *Fusarium oxysporum, Curvularia* sp., *Chaetomium* sp., *Alternaria* spp., *Helminthosporium* spp., *Rhizopus nigricans.*

1085. KILPATRICK, R. A., and E. E. HARTWIG. 1955. Fungus infection of soybean seed as influenced by stinkbug injury. Plant Dis. Reptr. 39:177–180.

Soybean seeds obtained from a date-of-planting study showed a high percentage of stinkbug injured seeds, especially at the later planting dates. Isolations from punctured and nonpunctured seed yielded a number of different fungi; however, the data suggest that stinkbug injury is not necessary for fungus infection of soybean seed. Symptoms on the seed varied, depending on stage of development when injury occurred. Seeds punctured at an early stage of development were small, shriveled, and poorly developed. Seed injured at a later stage generally showed the puncture surrounded by a discolored ring. *Cercospora kikuchii, Chaetomium* sp., *Fusarium oxysporum, Cladosporium* spp., *Aspergillus* sp. *Alternaria* spp., *Phomopsis sojae, Penicillium* spp., *F. roseum, Colletotrichum truncatum, Helminthosporium* spp., *Phyllosticta* sp., *Trichoderma* sp., *Colletotrichum destructivum, Aspergillus niger, Rhizopus nigricans, Curvularia* sp.

1086. KILPATRICK, R. A. 1956. Longevity of *Cercospora kikuchii* on soybean stems. Phytopathology 46:58.

Soybean stems heavily infected with *Cercospora kikuchii* were collected from field plots at Stoneville, Miss., in October 1951. These were tied in a bundle and hung outside the laboratory window. At 6-month intervals thereafter, sections of stems were removed from the bundle and incubated in a moist chamber for 48 hr. Lesions were then examined for sporulation of the fungus. Conidia of *C. kikuchii* were very abundant during the first 18 months, generally decreasing in number with each successive period of examination. After 42 months, however, the fungus could still be isolated from stem sections, suggesting that the fungus can survive on plant debris for a number of years. It would appear that the fungus overwinters on stem lesions as well as on seed.

1087. KILPATRICK, R. A., and H. W. JOHNSON. 1956. Sporulation of *Cercospora* species on carrot leaf decoction agar. Phytopathology 46:180–181.

Particular attention is devoted to *Cercospora kikuchii* from soybeans. The medium was prepared as follows: 300 g of plant tissue was ground finely and added to 500 ml distilled water. The material was then steamed without pressure for 1 hr. and strained through two layers of cheesecloth. The strained decoction was added to 500 ml distilled water containing 12 g of dissolved agar and volume was adjusted to 1 liter. Following sterilization 25 ml medium was poured in plates and just before solidification the mycelium transfer was streaked in the liquid medium. The dishes were covered with wet towels and held at room temperatures 3–5 days.

1088. KILPATRICK, R. A., and H. W. JOHNSON. 1956. Purple stain of legume seeds caused by *Cercospora* species. Phytopathology 46:201–204.

Soybean seeds, which remained fungus-free for 48 hr. when plated on potato-dextrose agar containing 50 ppm of the Na salt of 2,4-D to inhibit germination, were inoculated by placing a small agar cube containing mycelium of a *Cercospora* isolate on the seed coat of each seed. Of 39 isolates representing 18 *Cercospora* species from 21 different host species, 35 isolates from 20 hosts produced a pink to purple discoloration of soybean seeds similar to that produced by *C. kikuchii* under

field conditions. Only *C. kikuchii* has been isolated from field-collected soybean seeds showing purple stain symptoms. Fifteen isolates, 13 of which had discolored soybean seeds, were tested also on white seeds of snapbean, lima bean, lupine, and cowpea. The 13 that had discolored soybean seeds also produced a pink to purple discoloration of seeds of these four other legumes. Discoloration was evident on the seed coats within 48 hr. after inoculation, and final readings were made 3–4 days later. The technique employed appears to offer a fairly rapid laboratory method for studying discoloration of legume seeds caused by *Cercospora* spp.

1089. KILPATRICK, R. A. 1957. Fungi associated with the flowers, pods, and seeds of soybeans. Phytopathology 47:131–135.

Studies of the fungi associated with flowers, pods, and seeds of soybeans were made at the Delta Branch Experiment Station, Stoneville, Miss., from 1951 to 1955. Kinds of fungi and their relative prevalence varied with season, location within the plant, and cultivars. *Alternaria* spp. were isolated most frequently from the pistil and stamens of unopened and opened flowers and from style and stigma remains adhering to pod tips. *Cercospora kikuchii* comprised the highest percentage of isolates from seed within pods. Infection of the pistil and stamens was less in unopened than in progressively older flowers. The percentage of seed infection was lowest prior to maturity and gradually increased through and after maturity. In 66% of the cultivars and strains sampled over a 4-year period, 100% of the seed were infected by end of the sampling period, which extended from 1–6 weeks prior to maturity to 1–6 weeks after maturity. In 45% of the cultivars and strains sampled, 50% of the seed were infected by date of maturity. In only one cultivar (CNS) were 100% of the seed infected prior to maturity. In general, infection of 100% of the seed occurred sooner in early maturing varieties and strains than in later maturing ones.

It is suggested that fungi gain entrance to soybean seeds within unopened pods by the following means: (1) cracking of pod walls, (2) insect injuries, and (3) systemic infection. Of 3,845 unopened and opened flowers plated out over a 3-year period, fungus isolates were obtained from 281 or 7.3%. Of 5,248 styles and stigmas from pod tips plated out over the same period, fungus isolates were obtained from 3,587 or 68.4%. Of 11,800 seeds from within pods plated out over a 4-year period, fungus isolates were obtained from 5,200 or 44.1%.

1090. KIM, W. S., and D. J. HAGEDORN. 1957. Studies with virus incitants of pea streak. Phytopathology 47:526. (Abstr.)

Pea streak virus produced a yellow margined, red mottle on soybean.

1091. KING, T. H. 1948. Pod and stem blight of soybeans in Ohio, 1947. Plant Dis. Reptr. 32:193.

A short note on the occurrence and spread of *Diaporthe phaseolorum* var. *sojae*.

1092. KINGSLEY, T. 1960. Downy mildew of soybean. Plant Path. 9:38.

First report of downy mildew (*Peronospora manshurica*) for England. Found at Suffolk on cultivar Bansei, the pathogen is thought to have been introduced from United States with imported seed.

1093. KINLOCH, R. A., and J. H. WALKER. 1971. Root-knot diseases in Florida soybeans. Sunshine State Agr. Res. Rpt. 16(3):12–14.

A popular article describing losses, symptoms, and control by crop rotation with peanuts, field corn, grain sorghum, and summer fallow. Most promising is to use resistant cultivars such as Bragg and nematicides such as fumazone 86, mocha, nemacur, or tirpate, simultaneously.

1094. KINLOCH, R. A. 1971. Soybean root knot nematode (*Meloidogyne incognita*). Amer Phytopath. Soc. Fungicide and Nematicide Tests, Results of 1970. 26: 167.

Several nematicides were tested for effectiveness in controlling root-knot on a very uniform infestation of *Meloidogyne incognita* in Escambia County, Fla. Similar tests were conducted on soybean Hood (susceptible) and Bragg (moderately resistant). Fumazone 86 and telone were applied by injection gun. DuPont 1410 L was sprayed on a 14-in. band at rates of 5 lb. and 1 lb. active/acre, then incorporated into the soil using a rotary hoe. The lower dosage was followed by an additional 2 lb. active applied as a foliar spray at the first trifoliolate and again 3 weeks later. All other materials were applied in granular form in 14-in. bands and incorporated into the soil using a rotary hoe. All treatments produced significant increases in yield over untreated check plots within the cultivar treatments. However, nematicidal treatment of susceptible Hood did not produce yields that were significantly greater than Bragg cultivar without treatment.

1095. KINLOCH, R. A. 1972. Evaluation of varietal and nematicidal combination for the control of *Meloidogyne incognita* on soybean. J. Nematol. 4:228–229. (Abstr.)

Meloidogyne incognita on soybean in Florida indicated the necessity for proper soybean varietal selection in combination with nematicidal treatment to maximize yields on infested soil. Nematode control, as measured by yield data, was evaluated on replicated randomized field plots 6 m long and 2 rows wide on 0.9 m centers. Evaluated volatile nematicides were 1,2-dibromo-3-chloropropane (DBCP at 8.7 and 11.7 kg/ha) and 1,3-dichloropropene

(telone at 114.3 kg/ha). Nonvolatile nematicides evaluated at 1.7, 2.2, 3.4, and 4.5 kg/ha were 0,0-diethyl 0-p-methylsulfinyl phenyl phosphorothioate (dasanit), ethyl 4-(methylthio)-m-tolyl isopropylphosphoramidate (nemacur), S,S-diisopropyl 2-methoxyvinyl phosphonodithioate (chemagro 7375), 2,4-dimethyl-2-formyl-1,3-dithiolane oxime methyl carbamate (tirpate), S-methyl 1-(dimethylcarbamoyl)-N-[methylcarbamoyl)oxy] thioformimidate (vydate), VC9-104 (0-ethyl S,S-dipropyl phosphorodithioate), carbofuran, and aldicarb.

In one study, two cultivars were planted on infested land that had supported soybeans for several years. Untreated plots of soybeans Hood and Bragg yielded 209 and 1,642 kg/ha, respectively. Nematicidal treatment of Hood plots increased yields approximately 6- to 10-fold, with the greatest yield of 2,032 kg/ha from 11.7 kg DBCP/ha. Treatment of Bragg plots increased yields approximately 1-to 2-fold, with the greatest yield of 2,753 kg/ha from nemacur at 4.5 kg/ha. Treated Hood plots did not yield significantly more than untreated Bragg plots. In a second study, Hampton 266A soybeans grown on land that had supported field corn for the previous two years were compared with Bragg soybeans grown on adjacent land that had supported soybeans continuously for several years. Untreated plots yielded 1,050 kg/ha of Hampton 266A and 1,810 kg/ha of Bragg. Nematicidal treatments increased Hampton 266A by approximately 1- to 2-fold, with the greatest yield of 2,221 kg/ha from 11.7 kg DBCP/ha. Treatment of Bragg increased yields by approximately 1- to 1.5 fold, with the greatest yield of 2,699 kg/ha from 11.7 kg DBCP/ha. In both studies, treatment of susceptible cultivars Hood and Hampton 266A produced the greater yield increases. However, the greatest soybean production resulted from treatment of the more resistant cultivar Bragg.

1096. KINLOCH, R. A., and K. HINSON. 1973. The Florida program for evaluating soybean (*Glycine max* L. Merr.) genotypes for susceptibility to root-knot nematode disease. Soil and Crop Sci. Soc. Florida 32:173–176.

Soybean lines are evaluated for susceptibility to *Meloidogyne incognita* and *M. javanica* by the amount of root galling produced (0 = none, 4 = 75–100% of root galled). Numerous soybean lines were screened using this method and degrees of susceptibility have been defined. A program for developing soybean cultivars resistant to *Meloidogyne* spp. and the soybean-cyst nematode (*Heterodera glycines*) is in progress. Susceptible cultivars growing in nematicide-treated soils yielded less than resistant Bragg.

1097. KINLOCH, R. A. 1974. Response of soybean cultures to nematicidal treatment of soil infested with *Meloidogyne incognita*. J. Nematol. 6:7–11.

A comparison of untreated and nematicide-treated soil for soybean production revealed that *Meloidogyne incognita* hastened crop maturity and reduced plant weight, seed weight, and yield. Reductions of yield varied from 32–90% depending on cultivar susceptibility. Dibromochloropropane was more consistent in increasing crop performance than organo-phosphate or oxime carbamate nematicides. Greatest yield increases were produced by nematicidal treatment of soils planted to soybean cultivars with the lowest susceptibility.

1098. KINLOCH, R. A. 1974. Nematode and crop response to short-term rotation of corn and soybean. Proc. Soil and Crop Soc. 33:86–88.

1098a. KINLOCH, R. A., and K. HINSON. 1974. Comparative resistance of soybeans to *Meloidogyne javanica*. Nematropica 4:17–19. (Abstr.)

1099. KINOSHITA, S., and T. NISHIZAWA. 1955. On the soybean-sleeping blight, a new disease of soybean [in Japanese]. Kyushu Agr. Res. 15:74–76.

The causative pathogen is probably *Septogloeum sojae*.

1100. KINOSHITA, S., and T. NISHIZAWA. 1955. On the soybean blast *Septogloeum sojae* n.sp. I. Effect of the chemicals to the causal fungus [in Japanese]. Kyushu Agr. Res. 16:117.

1101. KIRKPATRICK, B. L. 1972. Studies on *Macrophomina phaseoli* and control by systemic fungicides in soybean. Master's thesis, Univ. Illinois. 43 pp.

1102. KIRKPATRICK, B. L., and J. B. SINCLAIR. 1973. Uptake of two systemic fungicides and their breakdown products by soybean seeds. Phytopathology 63: 1532–1535.

The growth of *Macrophomina phaseolina* (*Rhizoctonia bataticola*) on potato-dextrose agar (PDA) containing 5, 10, or 50 μg/ml of fungicides BD 18654 and topsin (TM) was significantly less than controls. Thin layer chromatography detected BD 18654 and a breakdown product in fresh aqueous solutions; the former but not the latter was heat-stable. *M. phaseolina* and *Penicillium atrovenetum* were sensitive to both compounds in vitro. TM was stable for 1 week in an aqueous solution, but yielded a breakdown compound, possibly MCB, during autoclaving. *M. phaseolina* was sensitive to both of these compounds, but *P. atrovenetum* was sensitive only to MBC. The four compounds, BD 18654 and its breakdown product, and TM and its breakdown product (MBC), were absorbed by germinating soybean seeds within 4 hr. Charcoal rot was not controlled if seeds were treated with either BD 18654 or TM at 5 and 10 g/kg.

1103. KIRKPATRICK, B. L., J. B. SINCLAIR, and P. N. THAPLIYAL. 1973. Soybean (*Glycine max*, Bragg) pre- and post-emergence damping-off (various

seed and soil borne organisms). Amer. Phytopath. Soc. Fungicide and Nematicide Tests. Results of 1972. 28: 151.

Bragg soybean seeds were selected for uniformity in size, shape, color, and disease-free appearance and then either nontreated (control) or treated with several fungicides at rates of 4 and 8 oz. active ingredient/100 lb. seed to control seed- and soil-borne pathogens causing stand reductions in the field. At 33 days after planting at both locations (India and Illinois), the number of healthy plants in each row was counted, the percentage of healthy seedlings recorded, and the data statistically analyzed. In India all treatments gave a significantly higher percentage of healthy seedlings than the control, except benlate at both rates and EL-273 at 4 oz./100 lb. The best treatments were vitavax at both rates and zinc omadine at 8 oz./100 lb. In Illinois, all treatments except vitavax at both rates and bay dam 18654 at 4 oz./ 100 lb. gave significantly higher percentages of healthy seedlings above the control. The best treatments in this experiment were topsin-M, arasan, and benlate.

1104. KISPATIC, J. 1950. A contribution to the list of parasitic fungi of Croatia [in Croatian, English summary]. Hrvatsko Prirodoslovno Drustvo., Ser. 2 B, 2/3: 44–50. 1948/1949.

Phyllosticta sojaecola Mass. is described as sometimes very damaging. First report for Croatia.

1105. KITANI, K., Y. INOUE, and T. NATSUME. 1960. Ecological studies on the mobilization of lime-sulphur spraying. Efficacy to the wheat brown rust and the soybean rust [in Japanese, English summary]. Shikoku Agr. Expt. Sta. (Zentsuji, Japan) Bull. 5, pp. 225–306.

When soybean plants in the field are sprayed with lime and sulfur, a gaseous substance evolves from deposits of the fungicide. This substance affects the uredosorus already formed, reducing germination rate. It also depresses the infectivity of scattered spores.

1106. KITANI, K., Y. INOUE, and T. NATSUME. 1960. Studies on effectiveness of lime-sulphur spraying on the wheat brown rust and the soybean rust [in Japanese, English summary]. Shikoku Agr. Expt. Sta. (Zentsuji, Japan) Bull. 5, pp. 307–318.

Studies were made on the relation of spray concentration to the control, the relation of amount of spraying to disease development, the effect of spreaders, metal salts, and polyethylene polysulfide added to the spray mixture.

1107. KITANI, K., and Y. INOUE. 1960. Studies on the soybean rust and its control measure. (Part 1) Studies on the soybean rust [in Japanese, English summary]. Shikoku Agr. Expt. Sta. (Zentsuji, Japan) Bull. 5, pp. 319–342.

Rust (*Phakopsora pachyrhizi*) occurs in various soybean-growing areas and is especially serious in the southwest of Japan. In Japan it occurs mainly from August to December, in Formosa from March to May, and in Okinawa in April. In the field, the initial attack is frequently on the lower leaves where it becomes well developed. Taxonomic notes on the fungus are given. Uredospores germinate in the range 8–32 C, the optimum approximately 25 C. Under natural conditions the uredospores are likely to lose their germinating power after 30–40 days.

1108. KITANI, K., Y. INOUE, and T. NATSUME. 1960. Studies on the soybean rust and its control measure. (Part 2) Studies on the control measure on the soybean rust [in Japanese, English summary]. Shikoku Agr. Expt. Sta. (Zentsuji, Japan) Bull. 5, pp. 343–358.

1109. KLARMAN, W. L. 1968. The importance of phytoalexins in determining resistance of soybeans to three isolates of *Phytophthora*. Netherlands J. Plant Path. Supp. I. 1968:171–175.

A model using two soybean varieties and three *Phytophthora* isolates is presented to explain the function of phytoalexin in certain types of host-parasite interactions. Resistant Harosoy 63 soybean plants produce seven times as much phytoalexin as susceptible Harosoy plants when inoculated with the pathogen *P. megasperma* var. *sojae*. When a portion of the phytoalexin is removed from the inoculation wounds, Harosoy 63 plants become as susceptible as Harosoy plants. Harosoy 63 plants produce only twice as much phytoalexin as Harosoy when both are inoculated with a nonpathogenic isolate of *P. megasperma* and equal amounts when inoculated with *P. cactorum,* also nonpathogenic. Plants of both cultivars become susceptible to both nonpathogenic fungi when portions of phytoalexin are removed from inoculation wounds. The three fungi do not differ significantly in their ability to stimulate phytoalexin production in Harosoy 63 plants. In Harosoy, however, both isolates of *P. megasperma* stimulate production of less phytoalexin than does *P. cactorum.* The nonpathogenic isolate of *P. megasperma* is four times more sensitive to soybean phytoalexin than *P. megasperma* var. *sojae,* which is twice as sensitive as *P. cactorum.*

1110. KLARMAN, W. L., and M. K. CORBETT. 1972. Electron microscopy of *Phytophthora megasperma* var. *sojae* in resistant and susceptible soybean hypocotyls. Phytopathology 62:670. (Abstr.)

Phytophthora spp. are generally intercellular pathogens. When soybean hypocotyls infected with *P. megasperma* var. *sojae* (*Pms*) were examined by electron microscope, however, the fungus was found to be both inter- and intracellular. Hypocotyls of 1-week-old plants, Harosoy (susceptible) and Harosoy 63 (resistant), were wound-inoculated with *Pms.* Within 48 hr., typical hypersensitive

reactions had occurred on resistant plants, whereas susceptible plants were water-soaked and flaccid. Sections from resistant plants 24 hr. after inoculation did not appear infected; after 72 hr., *Pms* was inter- and intracellular in all tissues adjacent to the point of inoculation, but integrity of the tissues was maintained. Sections from susceptible plants 24 hr. after inoculation contained abundant inter- and intracellular mycelium, and infected tissues were disorganized. In some sections, haustoria-like bodies were observed.

1111. KLARMAN, W. L., and F. HAMMERSCHLAG. 1972. Production of the phytoalexin, hydroxyphaseollin, in soybean leaves inoculated with tobacco necrosis virus. Phytopathology 62:719–721.

The phytoalexin, hydroxyphaseollin (HP), was detected in soybean leaves 30 hr. after inoculation with tobacco necrosis virus. Maximal concentration occurred 48–72 hr. after inoculation but HP decreased to approximately two-thirds of the maximum after 96 hr. Quantity of HP was proportional to the number of lesions per leaf provided sufficient uninfected tissue separated the lesions. When lesion number was high, HP concentration decreased. Hydroxyphaseollin was not detected in the noninoculated tissue, although it was noted that inoculation of one primary leaf with TNV interfered with establishment of TNV lesions in the opposite leaf when inoculated 48 hr. later.

1112. KLARMAN, W. L., and M. K. CORBETT. 1974. Histopathology of resistant and susceptible soybean hypocotyls inoculated with *Phytophthora megasperma* var. *sojae*. Phytopathology 64:971–975.

Hypocotyls of resistant and susceptible soybean plants were examined by light and electron microscopy 3 days after inoculation with *Phytophthora megasperma* var. *sojae*. All tissues of susceptible hypocotyls were ramified by both inter- and intracellular hyphae of the pathogen. Parenchyma near the site of infection was completely disorganized, but vascular tissues and cells with secondary walls remained intact even when heavily infected. In inoculated hypocotyls of resistant plants only those cells directly surrounding the inoculation wound were colonized by the pathogen, and normal-appearing organelles were present in adjacent noninfected host cells. Some host cells close to the infected area were filled with granular, dark-staining cytoplasm which appeared to form a barrier to further movement of the fungus.

1113. KLEIN, H. H. 1958. Etiology of Phytophthora disease of soybean. Diss. Abstr. 19:651.

Morphology of *Phytophthora* sp. inciting the root and stem rot of soybean and also the factors affecting it were investigated. The recovery of pathogen from field soil as determined by plant assay technique was very low after the soil became dry but after prolonged wet conditions recovery was quite high. Viable fungus was found in soil that was inadvertently included in seed samples at harvest. Some Harosoy plants in steamed soil became diseased after treatment with water from flooded diseased plants. The pathogen was isolated from immature seeds taken from pods within an advancing margin of stem rot and from stem lesions, also from seeds only after a 2-month cold-wet treatment.

1114. KLEIN, H. H. 1959. Factors affecting development and morphology of reproductive structures of the soybean root and stem rot *Phytophthora*. Phytopathology 49:376–379.

Some factors affecting morphology of the *Phytophthora* species inciting root and stem rot of soybeans were investigated. Type of medium and source of water affected formation of sporangia. Sporangial papillation was variable and affected by many factors. Type of medium, source of fungus, and age of culture affected type of sporangia germination. Type of medium and age of culture influenced the size of sporangia. Type of medium, especially the percentage of agar, influenced the frequency of oogonia and diameter of oospores. Intercalary sporangia and resting sporangia were observed.

1115. KLEIN, H. H. 1959. Etiology of the Phytophthora disease of soybeans. Phytopathology 49:380–383.

The incitant of root and stem rot of soybean was identified as a *Phytophthora* species by placing diseased tissues on a medium consisting of 2.3 g/liter difco lima bean agar. When the pathogen was present, sporangia developed and zoospores were produced within 48 hr. Recovery of the pathogen from field soil, as determined by plant assay, was low after the soil was exposed to dry conditions, but was conspicuously higher after prolonged wet conditions. Viable *Phytophthora* were found in soil mixed in seed samples by harvesting procedures. Soil can be an important means of spreading the pathogen within and between fields. Sporangia and zoospores may be important forms in which the pathogen is disseminated within fields. Abundant sporangia and zoospores developed on flooded diseased soybean plants in soil; some Harosoy soybean plants in steamed soil infested by this flood water became diseased, demonstrating presence of the pathogen in the water. The pathogen was isolated from immature seeds taken from pods within an advancing margin of rot from stem lesions, but was isolated from mature seeds only after a 2-month cold-wet treatment. The presence of other root pathogens influenced the severity of Phytophthora root and stem rot in steamed soil; total kill was significantly reduced with certain combinations of *Rhizoctonia solani* and *Phytophthora* or *Fusarium roseum* and *Phytophthora*. The etiological aspects studied and correlated to field conditions might be applied in future control programs.

1116. KLEMENT, Z., G. L. FARKAS, and L. LOVREKOVICH. 1964. Hypersensitive reaction induced by

phytopathogenic bacteria in the tobacco leaf. Phytopathology 54:474–477.

Pseudomonas tabaci was used as a check to show differences in symptomatology induced by pathogens and nonpathogens in tobacco.

1117. KLESSER, P. J. 1954. New records of legume virus diseases in England. Plant Path. 3:84.

Reports that soybean mosaic has previously been reported for England, and that soybean is susceptible to pea stunt virus, alsike clover mosaic virus, and white clover mosaic virus.

1118. KLESSER, P. J. 1960. Virus diseases of lupines. Bothalia 7:207–231.

Inoculated soybeans in South Africa showed the following reactions to: Lupine virus A — no local reaction; systemic reaction, diffuse chlorotic mottle develops. Lupine virus B — no local reaction; systemic reaction, chlorotic flecks on the younger leaves. Lupine virus C — local reaction, necrotic lesions in 12 days; systemic reaction, the first trifoliolates develop chlorotic flecks with necrotic rings and soon drop, most other leaves have vivid chlorotic flecks and later a mosaic with necrotic specks. Bean yellow mosaic virus — local reaction, small necrotic lesions develop in 12 days; systemic reaction, young leaves show chlorotic spots or flecks, and later ones show a diffuse mottle. Pea mosaic virus 4 — local reaction, chlorotic spots develop in 4–5 days; systemic reaction, after a month the leaves show chlorotic spotting, older leaves also have necrotic specks, the plant is stunted. Physical properties and identification of the viruses are discussed.

1119. KLESSER, P. J. 1960. Virus diseases of cowpeas. Bothalia 7:233–251.

The following are results of inoculation in a South African study: Cowpea mosaic virus A on *Glycine javanica* — local reaction, necrotic spots with chlorotic rings in 4 days; systemic reaction, leaves may have chlorotic areas or if symptomless, virus can be recovered. On *G. max* — local reaction, chlorotic spots may develop; systemic reaction, chlorotic spotting and vein flecking in 9 days, the next leaves develop a mottle with dark-green blisters and irregular yellow areas and are elongated and malformed with a crinkled surface, older leaves have necrotic specks. Cowpea mosaic virus B on *G. javanica* — local reaction, necrotic lesions develop in 8 days; systemic reaction, some leaves have large chlorotic blotches which are puckered. On *G. max* — local reaction, chlorotic rings develop in 10 days and leaves drop; systemic reaction, chlorotic specks and irregular areas causing distortion, necrotic specks on old leaves. Cucumber mosaic virus strain on *G. max* — local reaction, may be a general chlorosis in 4 days; systemic reaction, after 11 days a veinclearing of young leaves, later leaves are mottled with dark-green blisters with severe malformation. Identification of these viruses is discussed.

1120. KLESSER, P. J. 1960. Virus diseases of peas and sweet peas. Bothalia 7:253–282.

The following are results of inoculation in a South African study: Pea mosaic virus on *Glycine javanica* — a symptomless carrier. Pea stunt virus on *G. max* — local reaction, leaves become chlorotic and drop; systemic reaction, after a chlorotic spotting the leaves develop a mottle with some yellow specks, old leaves have a chlorotic network. Pea wilt virus, new strain on *G. javanica* — a symptomless carrier. On *G. max* — local reaction, chlorotic spots which later have a necrotic ring, some veinal necrosis; systemic reaction, in 9 days young leaves show veinclearing which becomes a dark-green mottle on the next-formed leaves which are puckered, some small necrotic spots on older leaves. Lucerne mosaic virus, necrotic ring strain on *G. max* — no local reaction; systemic reaction, chlorotic spotting of young leaves, later ones mottled and slightly crinkled. Bean chlorosis virus, strain B on *G. max* — no local reaction; systemic reaction, a diffuse chlorotic mottle on most leaves. Bean yellow mosaic virus, necrotic strain on *G. max* — no local reaction; systemic reaction, a diffuse chlorotic spotting. Tomato spotted wilt virus on *G. max* — local reaction, necrotic specks with chlorotic halos, leaves later become almost orange; no systemic reaction. Identification of these viruses is discussed.

1121. KLESSER. P. J. 1961. The virus diseases of *Crotalaria, Glycine,* and *Medicago* species. Bothalia 7:497–519.

A *Glycine* strain of alfalfa mosaic virus was isolated from naturally infected plants of *G. javanica* in South Africa. Twenty-five legume species, when inoculated, showed various reactions. On soybean — local reaction, necrotic specks, rings, and veins; systemic reaction, in 3 weeks young leaves develop a chlorotic network or star flecks, later leaves had vivid yellow areas and the plant was stunted. Alsike clover mosaic virus 1 — both *G. max* and *G. javanica* showed some symptoms when inoculated. Inoculation of white clover mosaic virus on *G. max* — local reaction, small necrotic specks with chlorotic halos in 10 days; systemic reaction, the young leaves develop a veinclearing and chlorotic spotting, later leaves are mottled with necrosis developing in the chlorosis causing a leaf pucker. On *G. javanica* — a symptomless carrier. Soybean mosaic virus — found in northern, eastern, and western Transvaal.

1122. KLESSER, P. J. 1961. The virus disease of beans. Bothalia 7:521–558.

Four strains of bean chlorotic ring spot virus were isolated from four different non-*Phaseolus,* naturally infected, legumes in South Africa. Strain B was isolated from soybean. The following are results of inoculation: Strain A on *Glycine javanica* — local reaction, chlorotic spots in 6 days; systemic reaction, a diffuse chlorotic spotting. Strains A and B on *G. max* — local reaction,

chlorotic specks or ring and line patterns; systemic reaction, in addition there are necrotic specks and with strain A the plant is stunted and rosetted. Strain C on *G. max* — no local reaction; systemic reaction, leaves have chlorotic patterns, irregular dark-green areas and are crinkled. Strain D on *G. max* — local reaction, slight veinal necrosis; systemic reaction, same as strain C.

1123. KLINKOWSKI, M. 1956. [Chlorophyll defects of Lucerne leaf, with special reference to the Lucerne mosaic virus (*Marmor medicagisis* Holmes)]. Phytopath. Z. 26:377–400.

Soybean leaf inoculated with the virus responded by clearings, especially along the veins.

1124. KLOSS, G. R. 1960. [Catalogue of phytophagous nematodes of Brazil.] Bol. Fitossanitario (Brazil) 8:1–26.

Xiphinema americanum, Helicotylenchus nannus, Ditylenchus dipsaci, Pratylenchus spp., and *Aphelenchoides parientinus* were found around roots of soybeans in São Paulo.

1125. KLYKOV, A. P. 1951. Bacteriosis of the cotyledons of soybean and its control with us [in Russian]. Mikrobiologiia (SSSR) 20:33–40.

Bacterium sojae (= *Pseudomonas glycinea*) and *B.* (= *Pseudomonas*) *solanacearum* were always found on seeds and sprouts infected with cotyledonary bacteriosis. Their pathogenicity was proved experimentally. Other experiments demonstrated presence of severe sprout infection and possible localization of bacteria in the seed coat, sprout, and bud. The disease is undoubtedly seed-transmitted. It is characterized by difference in concavity, color, and gloss, and sometimes by rupture of the seed coat. The exclusion of seed showing these characteristics reduces the percentage of infected sprouts but does not completely eliminate the disease. The systematic increase of infected sprouts in unsterilized soil indicates probability of soil infection. Seed treatment with granosan powder at 5 kg/ton produced a larger number of sprouts and greater yield. The author states "Should be noted that isolates 20 and 37 could be identified as *Bacterium* (= *Xanthomonas*) *medicaginia* var. *phaseolicola* with symptoms almost indistinguishable from those caused by *B. sojae* (= *P. glycinea*)."

1126. KLYKOV, A. P. 1953. Means of controlling bacterial diseases of soybeans [in Russian]. Zemledelie SSSR. 1(5):121–122.

Measures for control included application of protective material (such as use of dyes) to the seed and the effectiveness of such against bacteriosis of cotyledons, blight, and leaf spots.

1127. KLYKOV, A. P. 1963. Bacterial diseases of soybean [in Russian]. Zashch Rast. Moskva. 8:35–36.

Common in U.S.S.R. are cotyledon bacteriosis (damage 30–95%) caused by *Pseudomonas glycinea* and *P. solanacearum,* brown angular leaf spot (*P. glycinea*) occurring from flowering to yellowing of the leaves, rust-brown bacteriosis due to undetermined yellow-pigment bacteria, and wilt caused in the Krasnodar region by *P. solanacearum.* Seed treatment with granosan, mercuran, and thiram gave the best control.

1128. KMETZ, K., A. F. SCHMITTHENNER, and C. W. ELLETT. 1973. Systemic infection of soybean seed-rotting *Diaporthe* and *Phomopsis* spp. 2nd Internatl. Cong. Plant Path. Abstrs.:0449.

Two types of *Phomopsis* spp. were consistently isolated from immature stems of 31 cultivars and blends of field-grown soybeans. One isolate produced pycnidia and perithecia and resembled *Diaporthe phaseolorum* var. *sojae,* while the other formed only pycnidia like *P. sojae*. *Diaporthe* was noninfectious and *Phomopsis* infected 40% of stem-inoculated 66-day-old greenhouse-grown Cutler 71 soybeans. Incidence of *Diaporthe* and *Phomopsis* in stems increased throughout the season. The fungi were isolated from pods 1 week after pod setting. A second variant of *P. sojae* was obtained from green pods and seeds 1 week prior to yellowing of pods. This isolate infected 80% of stem-inoculated Cutler 71 plants. Occurrence of *Diaporthe* and the two variants of *Phomopsis* in pods and seeds increased up to and after maturity. At leaf fall *D. phaseolorum* var. *sojae* rotted disease-free seed on moist filter paper within 96 hr. after inoculation. *D. phaseolorum* var. *caulivora* partially colonized seed and arrested germination by 6 days while var. *sojae* inhibited germination of noncolonized seed by 9 days. Percentage of obviously moldy seed was 15, 12, and 20% of *Diaporthe,* and *Phomopsis* in seed was 61, 88, and 95%. Percentage germination of seed averaged 66, 34, and 6% when harvested at leaf fall, 1 month after leaf fall, and on November 16, respectively.

1129. KMETZ, K., C. W. ELLETT, and A. F. SCHMITTHENNER. 1974. Isolation of seedborne *Diaporthe phaseolorum* and *Phomopsis* from immature soybean plants. Plant Dis. Reptr. 58:978–982.

Diaporthe phaseolorum var. *sojae* and a species of *Phomopsis* were isolated from above-ground parts of 31 cultivars of field-grown soybeans. Percentage of plants from which the fungi were isolated increased from 11% four weeks after planting to 66% seven weeks after planting. The frequency of *Diaporthe* and *Phomopsis* was higher in lower portions of the plant than in upper portions, higher in stems than in green pods, and higher in green pods than in seed. Percentage of *Diaporthe*- and *Phomopsis*-infected seed increased and percentage of seed germination decreased, but percentage of moldy seed did not change with time of harvest after maturity. Three distinct *Phomopsis* types were obtained from infected seed: A form that produced only pycnidia and readily rotted inoculated seed, here designated as *Phomopsis* sp.;

a form that produced pycnidia and perithecia characteristic of *D. phaseolorum* var. *sojae* and which slightly inhibited seed germination and caused limited seed rot; and a form that produced pycnidia and perithecia characteristic of *D. phaseolorum* var. *caulivora* and was capable of inducing stem canker symptoms and was moderately virulent on seed.

1129a. KMETZ, K., C. W. ELLETT, and A. F. SCHMITTHENNER. 1974. Effect of crop history on the incidence of *Phomopsis* and *Diaporthe* in soybean plants and seed. Proc. Amer. Phytopath. Soc. 1:41. (Abstr.)

Season-long development of *Phomopsis* sp. and *Diaporthe phaseolorum* var. *sojae* in soybean plants and seed was followed in cultivars Amsoy 71, Wayne, and Calland in soil previously cropped to soybeans (SS) or corn (CS). *Phomopsis* and *Diaporthe* were first isolated from emerging seedlings. Incidence of both increased as plants aged, reaching levels of 90% and 80%, respectively, at maturity. Recovery of *Phomopsis* was higher (up to 90%) than *Diaporthe* (up to 30%) at each growth stage in plants from SS but *Diaporthe* was higher (up to 90%) than *Phomopsis* (up to 50%) in CS plants. Incidence of *Diaporthe* in SS and *Phomopsis* in CS plants was less than 30% until maturity. Mean incidence of *Phomopsis* in seed from four harvest dates was higher in plants from SS (64%) than from CS (37%); mean incidence of *Diaporthe* in seed was less (9% from SS, 17% from CS plants). Percentage seed infected with *Diaporthe* and *Phomopsis* increased with delay in harvest. Germination of seed at maturity was as high from SS as from CS plants. Germination of seed harvested 2 months after maturity was significantly less, as much as 73%, than seed harvested 1 month after maturity.

1130. KNIERIM, J. A. 1963. Nematodes associated with crop plants in Michigan. Quart. Bull. Michigan Agr. Expt. Sta. 46(2):254–262.

Report on the occurrence of nematodes in genera *Heterodera, Hoplolaimus, Paratylenchus, Tylenchorhynchus, Tylenchus,* and *Xiphinema* in two soil samples collected from soybean fields in Michigan.

1131. KOBAYASHI, K. 1959. The spore dissemination of soybean blast fungus *Septogloeum sojae* and the control method by fungicides [in Japanese]. Kyushu Agr. Res. 21:156–157.

1131a. KOCH, L. W., and A. A. HILDEBRAND. 1944. Soybean diseases in southwestern Ontario in 1943. Canad. Plant Dis. Surv. Ann. Rpt. 23 (1943), pp. 29–32.

Records occurrence, prevalence, and symptoms of diseases caused by *Diaporthe phaseolorum* var. *sojae, Phyllosticta sojaecola, Fusarium oxysporum* f. *tracheiphilum, Peronospora manshurica, Colletotrichum glycines* (= *C. dematium* f. *truncata*), *Cercospora sojina, Septoria glycines, Ascochyta* sp., *Alternaria* sp., *Pseudomonas glycinea,* and tobacco ring spot virus.

1132. KOCH DE BROTOS, L., and C. ROASSO. 1955. List of plant diseases in Uruguay [in Spanish]. Uruguay Dir. de Agron. Pub. 106. 65 pp.

Macrophoma phaseoli (= *Macrophomina phaseolina*) causes a rot at the base of the stem. It appears sporadically and at times is severe.

1133. KOCHMAN, J., and T. STACHYRA. 1957. Material on virus diseases of plants in Poland [in Polish, English summary]. Rocz. Nauk Rolnicz. Ser. A-Roslinna 77:297–325.

Soybean mosaic is discussed as to symptoms. The disease was not important but in 1956, in one area (Bydgoszczy), it affected about 20% of the plants.

1134. KODAMA, T., and J. B. BANCROFT. 1964. Some properties of infectious ribonucleic acid from broad bean mottle virus. Virology 22:23–32.

Young primary leaves of Bansei soybeans were used for quantitative local-lesion assays, as they gave consistent results.

1135. KOEHLER, B. 1931. Diseases of soybeans in Illinois. Proc. Amer. Soybean Assoc. 3:60–64.

An account, chiefly on symptoms and effects, of the following diseases: Mosaic, bacterial blight (= *Pseudomonas glycinea*), pod and stem blight (*Diaporthe phaseolorum* var. *sojae*), Fusarium blight, root and stem rots caused by *Pythium* sp. and *Sclerotium rolfsii,* and downy mildew (*Peronospora manshurica*).

1136. KOEHLER, B. 1943. Results of uniform seed treatment tests on soybeans. Plant Dis. Reptr. Suppl. 145:76–79.

Yield increase was obtained by treating oil-type soybean with semesan, fermate, new improved ceresan, and spergon, in half of the localities tested. Seed treatment did not affect nodulation.

1137. KOEHLER, B. 1944. New developments in soybean disease studies. Soybean Dig. 4(8):6–7.

Occurrence and prevalence of charcoal rot, pod and stem blight, bacterial pustule, and bud blight on soybean in the United States are reviewed. Tobacco ring spot virus causes spotting and falling off in Illinois, but causes bud blight in Iowa. In cooperative seed treatment tests, spergon gave the highest stand increase in three northern states using a Manchu type of soybean. In the other six states, where Lincoln cultivar was grown, best results were obtained with arasan. Only one case showed a significant increase of yield. In another series of tests, emergence of Mukden seed type of soybean was significantly benefited by seed treatment with spergon and arasan in 6 out of 13 states.

1138. KOEHLER, B. 1946. Marked damage brown stem rot. Soybean Dig. 7(1):17.

A popular article, stating that soybean sustained heavy damage from brown stem rot disease in 1946. The unnamed pathogen is soilborne, but not carried on the seed.

1139. KÖHLER, E., and K. HEINZE. 1941. [Übertragungsversuche mit dem mosaikvirus der sojabohne.] Landw. Jahrb. 90:233.

Soybean mosaic virus can be transmitted by rubbing of the sap. In bush bean and summer vetches the virus infection could be confirmed by retransmission only from the leaves which have been rubbed.

1140. KÖHLER, E. 1964. General virus pathology of plants. A survey [in German]. Berlin. 178 pp. + p. vii.

Discusses developments in plant virology since the 1954 edition of Sorauer's *Handbuch der Pflanzenkrankheiten.*

1141. KOLIOPANOS, C. N., and A. C. TRIANTAPHYLLOU. 1971. Host specificity and morphometrics of four populations of *Heterodera glycines* (Nematoda: Heteroderidae). J. Nematol. 3:364–368.

Four populations of *Heterodera glycines* from four different states differed considerably in number of adult females developed on five resistant soybean cultivars, mungbean, and lespedeza. Differences were observed also in body, tail, and tail terminus lengths of second-stage larvae. No attempt was made to assign these populations to recognized races, and it is suggested that race designations should be applied only to representative samples of field populations and not to selected greenhouse populations or isolates.

1142. KOLIOPANOS, C. N. 1972. Hybridization between two populations of *Heterodera glycines.* 11th Internatl. Symposium of Nematol., Eur. Soc. Nematol., Reading, U. K., pp. 37–38. (Abstr.)

A study of mode of inheritance of the ability of a population of *Heterodera glycines* to reproduce on resistant soybean cultivars, with observations on morphometrics of the F_1 larvae.

1143. KOLIOPANOS, C. N., and A. C. TRIANTAPHYLLOU. 1972. Effect of infection density on sex ratio of *Heterodera glycines.* Nematologica 18:131–137.

Approximately equal numbers of males and females of *Heterodera glycines* developed on roots of soybean seedlings at low infection densities. High infection densities significantly increased the male to female ratio, first in the secondary and tertiary roots and then in the primary roots. Infection density of secondary roots influenced nematode sex ratio in tertiary roots. Increased male to female ratios were attributed to differential death-rate of male and female larvae under conditions of food stress created by crowding.

1144. KOMIYA, S., and K. KUDO. 1960. Studies on the control of soybean yellow dwarf caused by cyst nematode. I. Control by chemicals — (DD) [in Japanese]. Meiji Univ. (Tokyo) Fac. Agr. Bull. 10, pp. 22–24.

1145. KOMIYA, S., and K. KUDO. 1961. Studies on the control of adzuki bean yellow dwarf caused by cyst nematode (preliminary report). Meiji Univ. (Tokyo) Fac. Agr. Bull. 12, pp. 27–29.

1146. KOMIYA, S., and K. KUDO. 1961. Studies on the control of soybean yellow dwarf caused by cyst nematode. Varietal differences of resistance to soybean yellow dwarf (1) [in Japanese]. Meiji Univ. (Tokyo) Fac. Agr. Bull. 12, pp. 31–36.

Studies on cultivars, made during 1958–1960.

1147. KOMIYA, S., and K. KUDO. 1963. Studies on the control of soybean yellow dwarf caused by the soybean-cyst nematode; control by chemical (DD) [in Japanese, English summary]. Meijidaigaku Kagokugi-jutsukenkyusho Kiyo 15:1–6.

Tests were conducted to study the effect of DD for controlling the yellow dwarf disease of soybeans. Treated plots had obtained about six-fold yields compared with those of nontreated plots.

1148. KOMIYA, S., and T. YAEGASHI. 1964. Studies on the control of soybean yellow dwarf caused by cyst nematode, *Heterodera glycines.* I. Control by chemicals — EDB [in Japanese, English summary]. Meijidaigaku Nogakubu Kenkyuhokoku 17:1–3.

Ethylene dibromide (EDB) effectively controlled yellow dwarf and increased the yield in treated plots.

1149. KOMIYA, S., and T. YAEGASHI. 1964. Studies on the control of soybean yellow dwarf caused by cyst nematode, *Heterodera glycines.* II. Varietal differences of resistances to soybean yellow dwarf [in Japanese, English summary]. Meijidaigaku Nogakubu Kenkyuhokoku 17:5–7.

Differences in resistance of soybean cultivars to yellow dwarf were determined. Tohoku-No. 6 did not suffer as much as other cultivars in the test and its yields were higher.

1150. KOMURO, Y., and M. IWAKI. 1968. Bean yellow mosaic virus and tobacco ring spot virus isolated from *Crotalaria* (*Crotalaria spectabiles*) [in Japanese, English summary]. Ann. Phytopath. Soc. Japan 34:7–15.

Strains of tobacco ring spot virus differed from those previously described in being noninfectious to Cucurbitaceae and in causing symptoms on soybean. Spherical particles 26 nm diameter, thermal death point 65 C, and dilution end point 1/5000, longevity in vitro 7 days at warm temperatures. This is the first report of tobacco ring spot virus in Japan.

1151. KORETSKII, P. M. 1970. Germination and viability of oospores of *Peronospora manshurica* (Naum) Syd. [in Ukrainian]. Mikol. i. Fitopatol. 4:3–8.

Oospores of the fungus germinated and caused infection of soybean plants when kept in contact with the seed for up to 1 year. Longer periods of storage under warm or cool conditions led to loss of viability, as did treatment in 96% alcohol for 45 sec., storage at −22 to −25 C for more than a day and drying of overwintered oospores in plant remains. The greatest number of oospores germinated after soaking the seed 4–6 days but longer soaking sharply decreased this number.

1152. KORETSKII, P. M. 1971. [Inoculation of soybean with the causal agent of peronosporosis.] Mikol. i. Fitopatol. 5:395–398.

During seed swelling and germination, infection was caused by both oospores and conidia of *Peronospora manshurica*. The intensity of infection decreased with age of plants.

1153. KORETSKII, P. M. 1973. Mode of overwintering of pathogen of soybean peronosporosis [in Russian]. Trudy Dal' nevost N S. Kh. 13:146–150.

Peronospora manshurica overwinters as oospores in various organs of infected plants. Infection is transmitted by seed and through soil containing infected plant residue.

1154. KORNFIELD, A. 1933. Leaf spot diseases of soybean — a potash deficiency phenomenon [in Rumanian]. Zeit. Pflanzen. Dung. u. Bodenk. 32:201–221.

In Rumania the symptoms of potash deficiency include an irregular spotting and sometimes chlorosis of the foliage and precocious maturity with its concomitants of defoliation and reduction in yield. Among the internal modifications are starch accumulation and a feeble development of the blast of the stem with subsequent tendency to lodging. Affected plants are liable to attack by bacterial diseases, particularly *Bacterium* (= *Xanthomonas*) *phaseoli* var. *sojense* and *B. glycineum* (= *Pseudomonas glycinea*).

1155. KORNFIELD, A. 1935. Schädigungen und krankheiten der ölbohne (soja), soweit sie bisher in Europa bekannt geworden sind. Zeitschr. Pflanzenkr. 45:577–613.

A detailed account on weeds, insect and other animal injuries, and physiological and parasitic diseases affecting soybeans in Europe. The diseases of physiological nature include those caused by acid soil, drought, deficiencies, frost, hail, and unsuitable harvesting and storing conditions. The parasitic diseases include downy mildew, brown spot, frog-eye spot, Fusarium wilt, anthracnose, bacterial blight, and a rust-spotting disease caused by *Pseudomonas phaseoli*. Two diseases of unknown nature, namely curly leaf and dwarfing, are also described.

1156. KOSHIMIZU, S., and T. IIZUKA. 1957. Relationship between the brown speck of soybean seed and soybean mosaic [in Japanese]. Ann. Phytopath. Soc. Japan 22:18. (Abstr.)

Brown speck, formerly believed to be the result of some unknown environmental condition, is reported to result from soybean mosaic infection.

1157. KOSHIMIZU, Y., and N. IIZUKA. 1963. Studies on soybean virus diseases in Japan [in Japanese, English summary]. Tohoku (Japan) Natl. Agr. Expt. Sta. Bull. 27, pp. 1–103.

Soybean mosaic virus (SMV), a detailed account of which is given, was found to be the commonest in the area, but from diseased leaves of a cultivar immune from SMV another virus, designated soybean stunt (SSV), was isolated in 1955. Mottling was shown to be associated with presence of both viruses. Cultivars immune from SMV did not produce mottled seeds in the field, but susceptible cultivars excepting Kingenichigo, did. SMV was shown to be seedborne. Studies on the inheritance of immunity are described. Early symptoms of SSV are top-bending, and veinclearing of growing leaves; mild leaf mottling with slight crinkling and size reduction follows, and greater shortening of petiole and internode than is caused by SMV; maturity is delayed in relation to severity of the disease. In some cultivars the symptoms are masked. The mottle pattern, which generally consists of concentric rings, appears on the seeds and is quite distinct from the radial mottle caused by SMV, though the latter pattern appears when plants are infected after flowering. Transmission is by sap or by aphids *Aphis glycine, Myzus persicae,* and *Rhopalosiphum prunifoliae* [*R. insertum*], or through seed. SSV mixes readily with SMV to produce severe symptoms; it has a death point of 55–60 C, a dilution end point of 1:1,000–1:10,000, and survives 3–4 days in vitro at 20–30 C. It is widespread, alone or with SMV, notably in S. Tohoku.

Other legume viruses in the area include lucerne mosaic, widespread on red and white clover or on soybean growing nearby, and bean yellow mosaic, which is very rare. An unidentified virus isolated in 1955 produces squarish spots on mature leaves during early stages of infection, the symptoms being hard to distinguish from those of SMV. It is easily transmitted mechanically, though not by aphids, and seed transmission (about 2%) has been observed. There is also a different strain of SMV which occurs yearly in the field after July. A final section analyzes the pigments obtained from mottled seed, the percentage of which was much lower when plants were infected after flowering. Mottling clearly depends on three interacting factors: the viruses, the host cultivars, and the time at which the embryo becomes infected, though it may also result from disturbance of the equilibrium within the genetic actions controlling production of seed-coat pigment, possibly due to abnormalities in

nucleic acid metabolism caused by virus multiplication in the infected cells.

1158. KOTOVA, V. V., Z. N. KHALEEVA, and E. G. SHEKUNOVA. 1965. [Fungus diseases of legumes.] *In* I. Y. Polyakov and A. E. Chumakov (eds.), [Distribution of pests and diseases of crops in U.S.S.R. in 1964.] Trudy Vses Inst. Zashch Rast. 25:159–164.

Data are given on *Ascochyta sojaecola, Peronospora manshurica, Sclerotinia libertiana* (= *Whetzelina sclerotiorum*) on soybean in U.S.S.R.

1159. KOVACHEVSKY, I. C. 1938. Parasitic fungi new for Bulgaria. Fifth contribution [in Bulgarian, English summary]. Rev. Inst. Rech. Agron. Bulg. 8(4):3–13.

Bacterium glycineum (= *Pseudomonas glycinea*) recorded for the first time in Bulgaria.

1160. KOVACHEVSKY, I. C. 1955. Parasitic fungi new for Bulgaria. VI [in Bulgarian, English summary]. Bulgar. Akad. na Nauk Bot. Inst., Izv. 4:301–312.

Sclerotium bataticola (= *Macrophomina phaseolina*) was observed on soybean at Pavlikeni in 1952. This is the first report on this host for Bulgaria.

1161. KOWALSKA, C. 1971. [*Lupinus polyphyllus*— Russells form as a natural host of tobacco ring spot virus.] Roczn. Nauk Roln. Ser. E. 1:17–24.

Tobacco ring spot virus is seedborne in soybean.

1162. KRASNOVA, M. V. 1963. The effect of some physical factors on the causal agent of bacteriosis in soybean seeds [in Ukrainian, English summary]. J. Mikrobiol. Kiev 25:50–52.

Seeds of soybean were used to test the efficiency of disinfection by (a) high-voltage electric currents, (b) ultrasonic radiation, and (c) VHF radio waves. On passing electricity at 4 kw/g for 30 sec. through seed, infection decreased from 5.9 to 2%, the degree of disinfection depending on voltage and exposure. Bacterial infection in plants grown from seeds exposed to ultrasonic radiation decreased with exposure; after 21.3 Kc/sec for 15 min. Cotyledon bacteriosis (*Pseudomonas glycinea* and *P. solanacearum*) and angular leaf spot (*P. glycinea*) were 16.5 and 40.4% respectively, compared with 30.8 and 73.2% in control plants. No specific results were obtained with VHF waves though leaf spot was inhibited. Germination was not affected by any of the treatments.

1163. KRASNOVA, M. V. 1963. Bacteriosis of soybeans and their control in the northern Caucasus [in Russian]. Agrobiologiia 1963:738–743.

Yields are reduced by up to 50% by cotyledon bacteriosis and up to 38% by leaf bacteriosis, both caused by *Xanthomonas phaseoli* var. *sojense* and *Pseudomonas glycinea.* The latter reduces the organic matter of leaf by 27–42%. Respiration and peroxidase activity rise sharply and there is a marked increase in catalase activity. The most resistant cultivars were Kubanskaya 4958, Kharbinskaya 111, and Nepolegayushchya 2. Of the fertilizers tested only the bacterial preparations phosphorobacterin and nitrobacterin reduced cotyledon infection. Seed treatment with granosan, mercuran, gerišan, agronol, and thiram reduced infection by 50%or more.

1164. KREITLOW, K. W., and W. C. PRICE. 1948. A new virus disease of ladino clover. Phytopathology 38: 15–16.

An abstract of entry 1165.

1165. KREITLOW, K. W., and W. C. PRICE. 1949. A new virus disease of ladino clover. Phytopathology 39: 517–528.

The virus systemically infected soybeans, causing stunting, veinal discoloration, downward curling, puckering, and reddish discoloration of affected tissues.

1166. KREITLOW, K. W. 1955. How to cut disease losses. Soybean Dig. 15(8):8–9.

A popular article emphasizing use of resistant cultivars to check losses from diseases. If resistant cultivars are not available, sanitary cultural practices and use of fungicides are recommended.

1167. KREITLOW, K. W., H. C. BOYD, D. W. CHAMBERLAIN, and J. M. DUNLEAVY. 1957. A bibliography of viruses infecting soybean (*Glycine max* (L) Merr.). Plant Dis. Reptr. 41:579–588.

A listing of 170 references.

1168. KREUTZER, W. A. 1941. Host-parasite relationship in pink root of *Allium cepa.* III. The action of *Phoma terrestris* on *Allium cepa* and other hosts. Phytopathology 31:907–915.

Phoma terrestris was isolated from the roots of soybean grown in infested soil, showing no external symptoms.

1169. KRUSBERG, L. R. 1959. Investigations on the life cycle, reproduction, and feeding habits and host range of *Tylenchorhynchus claytoni* Stiner. Nematologica 4:187–197.

Soybean was a fair host of *Tylenchorhynchus claytoni.*

1170. KUHN, C. W. 1963. Field occurrence and properties of the cowpea strain of southern bean mosaic virus. Phytopathology 53:732–733.

The bean mosaic virus was recovered from inoculated soybean cultivar Lee.

1171. KUHN, C. W. 1964. Separation of cowpea virus mixtures. Phytopathology 54:739–740.

Cowpea chlorotic mottle virus produced local lesions on soybean cultivar CNS-4.

1172. KUHN, C. W. 1964. Purification, serology and properties of a new cowpea virus. Phytopathology 54: 853–857.

Soybean is a local lesion host of this virus named as cowpea chlorotic mottle virus.

1173. KUHN, C. W. 1968. Identification and specific infectivity of soybean strain of cowpea chlorotic mottle virus. Phytopathology 58:1441–1442.

A strain of cowpea chlorotic mottle virus (CCMV) was isolated from soybeans and named as CCMV-S. In direct comparative tests between soybean isolate and cowpea isolate, no differences could be detected in host range, serology, UV- spectrophotometric ratios and sedimentation properties in sucrose. The two isolates were distinguished thus: (a) symptoms of CCMV-S were delayed on cowpea, (b) only CCMV-S caused systemic necrosis of soybean cultivars resistant to both isolates, (c) CCMV was higher in infectious quality than CCMV-S, and caused more virus nucleoprotein to be synthesized in cowpea than CCMV.

1174. KUHN, C. W. 1971. Cowpea chlorotic mottle virus local lesion area and infectivity increased by 2-thiouracil. Virology 43:101–109.

Treatment with 2-thiouracil caused cowpea chlorotic mottle virus (CCMV) lesion area on hypersensitive soybean to be enlarged 8–75 times. Lesion enlargement was detected 48 hr. after inoculation, and lesions increased in size rapidly for 6–8 days. Although soybean becomes more resistant (fewer and smaller lesions) with increasing age, thiouracil caused lesions to reach a similar size regardless of host age. Compared to controls, lesion area increased 2, 13, and 4 times at 21, 27, and 32 C, respectively. Increased lesion area was noted when thiouracil treatment began at 0, 12, and 24 hr. after inoculation, but not at 48 hr. The full effect, however, occurred when treatment began between 0 and 12 hr. When lesion area was increased 10–13 times, sap infectivity was increased 33–38 times. Increase in lesion size could be prevented when uracil (10^{-3} M) was added to thiouracil (10^{-4} M). Thiouracil treatment caused CCMV to move from one leaf half to another, but no systemic movement from one leaf to another was detected. CCMV sap infectivity was enhanced three times whereas tobacco mosaic virus sap infectivity was inhibited seven times by thiouracil in *Chenopodium amaranticolor,* a local-lesion host for both viruses.

1175. KUHN, C. W., J. W. DEMSKI, and H. B. HARRIS. 1972. Peanut mottle virus in soybeans. Plant Dis. Reptr. 56:146–147.

A mild strain of peanut mosaic virus was found infecting soybeans naturally. Mechanical inoculation of primary leaves of soybeans resulted in small chlorotic areas on the first two trifoliolates. Chlorotic patches and line patterns also appeared on third and fourth trifoliolates and the leaves developed later showed general mosaic. The virus appears to be widespread in United States and should be considered in soybean production and research programs.

1176. KULIK, M. M. 1957. Purple-stained soybean seed. Phytopathology 47:22.

Previous work has indicated that *Cercospora kikuchii,* the incitant of the purple stain disease of soybeans, can be isolated from apparently healthy as well as from purple-stained seed; these findings were confirmed by the present study. It therefore seemed desirable to determine whether the number of visibly affected (purple-stained) seed in a given lot could serve as a valid index of the total number of infected seed in that lot. Tests that involved 189 separate lots of seed from 14 locations and in which the percentage of purple-stained seed ranged from 0.0 to 31.5 showed that in most cases the number of purple-stained seeds in a given lot varied directly with the number of infected, but apparently healthy, seed in the same lot. Thus, lots showing large amounts of purple-stained seed invariably contained large amounts of infected but nonstained seed, and vice versa.

1177. KUNKEL, J. B. 1964. Brown stem rot syndrome development in soybeans. Diss. Abstr. 25(11):6146–6147.

Resistance of soybean to the brown stem rot fungus (*Cephalosporium gregatum*) has previously been evaluated in terms of disease incidence. Browning symptom parameters were evaluated in 22 soybean cultivars to determine the presence of a horizontal or field resistance to development of the pathogen with the host as indicated by concurrent initiation of the browning symptom. Infection rate and disease incidence varied between years and among cultivars. Rate of infection was not related to host stage of growth. Nodal length of the browning symptom differed among cultivars. When cultivars were ranked by mean nodal symptom length a relative order was established for cultivars between years. The rate of browning symptom advance in the stem occurred independently within the cultivar. Distribution plots of browning symptom lengths compiled periodically throughout the season described the development within cultivars of subpopulations susceptible or horizontally resistant to movement of the pathogen. Relative rates of stem browning increase within entire cultivar populations were highest prior to the pod filling stage of growth. Reduction in rate of host stem elongation did not increase the relative rate of stem browning.

1178. KUNKEL, J. F., and J. M. DUNLEAVY. 1965. Brown stem rot development in soybeans. Phytopathology 55:1065. (Abstr.)

Susceptibility of 22 cultivars of soybean to *Cephalosporium gregatum* varied from highly susceptible to slightly

susceptible. Rate of browning of stem pith by the fungus was used as an index of susceptibility. Ontario, the most susceptible cultivar, was characterized by a rapid increase in percentage of plants infected and a rapid rate of advance of browning in the stems. The cultivar Midwest was much less susceptible. In 1963, diseased stems of Ontario were 34% browned 55 days after emergence; diseased stems of Midwest exhibited only 2% of the pith browned. The absolute rate of advance of the fungus in the stems was much slower in Midwest than in Ontario. This rate tended to increase at 55 days after emergence for all cultivars tested. Relative rates of stem browning, compared among 8 cultivars, were independent of stage of growth and age of plants. Reciprocal grafts of Ontario and Midwest plants were evaluated for pith browning. Cultivar stocks did not alter the symptom length in scions, but there was a slight increase in susceptibility to infection of Midwest scions on Ontario stocks. A symptom-mitigating factor was therefore apparent in the aerial portions of the plants.

1179. KURATA, H. 1950. On the scab disease of soybeans [in Japanese]. Byogaichu Hassei Yosatsu Shiro No. 24:40–49.

A hitherto unknown but destructive disease was found on soybean. In the field, leaves, stems, and pods are affected. In severe cases of pod infection the seed may fail to develop. It is caused by *Sphaceloma* sp.

1180. KURATA, H. 1953. [Outbreak of soybean scab at Tohoku district. Climatic conditions affecting the outbreak and varieties relations [in Japanese]. Japan. J. Plant Prot. 45:108–112.

1181. KURATA, H., and K. KURIBAYASHI. 1954. Soybean scab caused by *Sphaceloma glycines* sp.nov. Ann. Phytopath. Soc. Japan 18:119–121.

First report of *Sphaceloma* on soybean. First discovered during a protracted rainy period in July 1947 in Nagano Prefecture, Japan. On leaves the scabs are circular to irregular, usually more or less elevated on the upper surface, sometimes coalescent, minute to about 4 mm in diameter, frequently visible on both surfaces of the leaf, commonly vinaceous buff, often fading to pale, drab, gray. On the stem, minute spots to elliptical, elongate scabs to 1 cm or more in length, up to 2 cm long when confluent, generally vinaceous buff in color, sometimes with reddish-brown margin. On pods, in general, young scabs are red to Kaiser brown, mature ones dark olive to black in color, lighter in the center with reddish-brown margins.

1182. KURATA, H. 1960. Studies on fungal diseases of soybean in Japan [in Japanese, English summary]. Natl. Inst. Agr. Sci. (Tokyo) Bull. Ser. C, 12, pp. 1–154.

Detailed cultural and physiological investigation on target spot (*Corynespora cassicola*); scab (*Sphaceloma glycines*), one of the most serious diseases of the crop in Japan; wilt (*Fusarium oxysporum* f. *tracheiphilum*) and *F. moniliforme*, of minor importance. Taxonomic studies were made on anthracnose fungi, including *Colletotrichum truncatum, C. glycines,* and *Glomerella glycines,* which is not the perfect stage of *C. truncatum.* One of the most widespread diseases is pod and stem blight (*Diaporthe phaseolorum* var. *sojae*), but stem canker (*D. phaseolorum* var. *caulivora*) has not been found in Japan. While purple stain (*Cercospora kikuchii*) is present in most areas, frog-eye (*C. sojina*) is a minor disease. Brown leaf blotch (*Mycosphaerella sojae*), brown spot (*Septoria glycines*) and downy mildew (*Peronospora manshurica*) also occur. Rust (*Phakopsora pachyrhizi*) causes severe damage locally. Other minor pathogens include leaf spots due to *Phyllosticta sojaecola, Ascochyta sojaecola,* pod canker (*Macrophoma mame*), blights by *Sclerotium rolfsii* and *Rhizoctonia solani,* stem rot caused by *Sclerotinia* (= *Whetzelinia*) *sclerotiorum,* charcoal rot (*Macrophomina phaseolina*), and basal stem rot (*Ophionectria sojae*).

1183. KUSANO, S. 1932. The host-parasite relationship in *Olpidium.* J. Coll. Agr. Imp. Univ. Tokyo 11: 359–426.

Olpidium trifolii and *O. viciae* can infect soybean through wounds by artificial inoculation.

1184. KUTOVA, I. 1972. Bacteriosis of *Digitalis lanata* [in Bulgarian]. Rastitelna Zashchita 20(9):18–20.

In Bulgaria *Pseudomonas fabae* from *Digitalis lanata* also infects soybeans. Biomycins, acetic acid, germisan, thiram, and bordeaux were most effective control measures.

1185. KUWAYAMA, S. 1926. The principal insects of the soybeans in Hokkaido [in Japanese]. Hokkaido Natl. Agr. Expt. Sta. Res. Bull. 39, pp. 1–94.

The cyst nematode on soybean is probably *Heterodera schachtii* or a biological strain of it.

1186. KUYAMA, S., and T. TAMURA. 1957. Cercosporin. A pigment of *Cercosporina kikuchii* Matsumoto et Tomoyasu. I. Cultivation of the fungus, isolation and purification of pigment. II. Physical and chemical properties of cercosporin and its derivatives. Amer. Chem. Soc. J. 79:5725–5729.

A pigment, cercosporin, has been isolated in good yield from cultured mycelia of *Cercosporina kikuchii.* Its molecular formula is $C_{30}H_{28}O_{10}$ and the presence of two methoxy, several acidic hydroxyl groups, and the quinoid system has been established. Conditions for culture of the fungus and isolation, purification, and general properties of the pigment are described. Several acetyl and methyl derivatives of cercosporin were prepared. Results indicate that cercosporin contains two quinoid carbonyl, two phenolic hydroxyl, and two alcoholic hydroxyl groups.

The infrared, ultraviolet and visible spectra of these derivatives suggest that cercosporin is a polyhydroxy derivative of a polycyclic quinone having an extended quinone system in which two phenolic hydroxyl groups are present in positions peri to the quinone carbonyls. By treatment with concentrated H_2SO_4, cercosporin is converted into noranhydrocercosporin, $C_{28}H_{20}O_8$, which contains no methoxy or alcoholic hydroxyl groups. Physical and chemical properties of noranhydrocercosporin and its derivatives are described.

1187. KVASHNINA, E. S. 1928. Preliminary report of the survey of diseases of medicinal and industrial plants in North Caucasus [in Russian, German summary]. N. Caucasian Plant Prot. Sta. Bull. 4, pp. 30–46.

Soybean suffered from two undetermined bacterial diseases, one on leaves and the other on leaves and pods. The latter is locally termed bacterial scorch.

1188. KVICALA, B. 1937. Susceptibility of soybean varieties to bacterial blight, as determined by artificial inoculations. Preliminary communication [in German]. Ann. Acad. Tchecosl. Agr. 12:266–271.

In Czechoslovakia soybean was severely attacked by bacterial blight (*Pseudomonas glycinea*). The disease is thought to be introduced with imported seeds. Of the 8 cultivars tested, Bratislavsk yellow SL1, Plattska large yellow, and Brnenska Chemelarova SVA1 were more resistant.

1188a. LACY, G. H., and J. V. LEARY. 1974. Transfer of a drug resistant (R) plasmid into *Pseudomonas glycinea* and *P. phaseolicola* in vitro and in plant organs. Proc. Amer. Phytopath. Soc. 1:55. (Abstr.)

An R plasmid from *Pseudomonas aeruginosa* 1822 was transferred to *Escherichia coli* X-705 from which it was transferred to *P. glycinea* R-6. High levels of chromosomal resistance to chloramphenicol and streptomycin in 1822 made selection difficult for R^+ recipients of R-6 and *P. phaseolicola* HB10Y and HB-36. Indirect transfer of the plasmid, conferring carbenicillin (Cb), tetracycline (Tc), neomycin, and kanamycin resistance, was possible by mating with X-705 (lac^+ Cb^s) and selecting for lactose fermentation on eosin-methylene blue agar plus 500 μg/ml Cb (EMB + Cb). X-705R^+ was used as the donor to R-6(met^- Cb^s). R-6R^+ selection was accomplished by (1) lack of lactose fermentation on EMB + Cb and (2) auxotrophy/prototrophy. Plasmid transfer was confirmed by the appearance of multiple antibiotic resistance, transfer of multiple resistance into new recipients, and acridine orange curing. The plasmid was transferred from R-6R^+ to HB10Y and HB-36. Some R^+ recipients lost the plasmid unless antibiotic stress was maintained, but most formed a stable complex without external constraints. A plasmid conferring only Cb and Tc resistance was isolated in HB-36. Transfer of the plasmid from R-6 to HB10Y in bean pods occurred when suspensions of the bacteria were injected into the endocarpic cavity.

1189. LAI, P. Y. 1968. Isolation of *Cephalosporium gregatum* from soybean straw. Phytopathology 58:1194–1195.

Soybean stems naturally infested with *Cephalosporium gregatum* were cut into small pieces and washed in tap water. Each piece was then immersed in 1:1 (v/v) mixture of 5.25% NaOCl solution and 95% ethanol, for 10–15 sec. Excess solution was drained and pieces were planted on potato-dextrose agar or soybean stem-agar and incubated at 18 C. Profuse sporulation occurred in 7 days. The fungus overwinters in plant debris in field.

1190. LAI, P. Y., and J. M. DUNLEAVY. 1969. Sporulation of *Cephalosporium gregatum* on naturally infested soybean straw. Phytopathology 59:343–345.

Cephalosporium gregatum sporulated abundantly on naturally infested soybean stems in a moist chamber, at temperatures ranging from 7.5–30 C, with the optimum at 18 C. The mean number of spores produced on stem surfaces in 10 days at 18 C was 332×10^5/sq cm. Sporulation occurred on stems after 3 days at 18 C. There was a positive correlation between length of incubation period and amount of sporulation for 14 days. The mean period in which spore populations doubled during 14 days of incubation was 2.4 days. At 18 C, *C. gregatum* sporulated continuously on the same pieces of stems, even after spores were removed four times at 10-day intervals. The number of spores decreased, however, each time they were removed. About 951×10^5 spores/sq cm of stem surface were obtained at first removal of spores. The number of spores decreased after each subsequent washing until 2×10^5 spores (0.2% of total number) were obtained after the fourth washing.

1191. LAI, P. Y., and J. M. DUNLEAVY. 1969. The effect of temperature upon germination of spores of *Cephalosporium gregatum*. Phytopathology 59:986–988.

Spores of *Cephalosporium gregatum* germinated in distilled water at 23 C after being frozen and thawed in water, but percentage germination decreased each time the spores were frozen and thawed. Spores frozen in water at −18 C after incubation for 10 hr. at 23 C had 41% less germination than spores similarly treated but chilled in water at 0 C. Viability of dry spores stored at 23 C was reduced from 88 to 0% in 20 days, whereas 5% of the dry spores stored at 5 C germinated after 40 days.

1192. LAI, P. Y., and J. M. DUNLEAVY. 1969. Sporulation and spore germination of *Cephalosporium gregatum* as influenced by host substrate and soil moisture. Phytopathology 59:1646–1649.

Residues from a mature soybean crop infested with *Cephalosporium gregatum* were collected from the field

and placed in a moist chamber. The fungus sporulated on all parts of the residue except on pods; however the rate of sporulation differed on various parts of the plant. Optimum sporulation occurred on the straw just above the second node. Sporulation on both stems and roots of mature plants decreased inversely with the distance from the second node. Optimum germination of spores of *C. gregatum* occurred in Webster silt clay soil with 20% moisture content at 23 C. Poorest germination occurred at 10% moisture content. As soil moisture content increased about 20%, spore germination gradually decreased. The highest percentage germination was observed after 4 days at 23 C in Webster silt clay loam ranging from 10–40% moisture content.

1193. LAI, P. Y., and J. M. DUNLEAVY. 1969. Growth and sporulation of *Cephalosporium gregatum* on various media and buried soybean straw. Phytopathology 59:1950–1953.

Sporulation of an Illinois isolate of *Cephalosporium gregatum* on soybean-seed agar was superior to that on soybean-stem agar previously determined as the best medium for growth and sporulation of this fungus. Only 49% of spores produced on soybean-seed agar germinated in water whereas 82% of spores produced on soybean-stem agar were viable. Sporulation of an Iowa isolate was most abundant on bean-pod agar, but percentage of spore germination in water was nearly the same as that of spores produced on soybean-stem agar. *C. gregatum* overwintered on soybean straw in the field. All soybean straw from infected plants placed in field soil or suspended above field soil supported good sporulation of *C. gregatum* when straws were placed in a moist chamber. The fungus also sporulated on naturally infected soybean straws after storage at −20, 2, and 24 C for 11 months in the laboratory.

1194. LAINER, T. J. 1960. Identification and distribution of the cyst-forming species of *Heterodera* with emphasis on the soybean-cyst nematode, *Heterodera glycines.* Control Plant Bd. Ann. Meeting, Columbus, Ohio, 1960.

The paper discusses morphological characteristics and distribution of species in the genus *Heterodera.* The life history and distribution of *Heterodera glycines* are discussed.

1195. LAMBAT, A. K., S. P. RAYCHAUDHURI, V. C. LELE, and R. P. NATH. 1969. Fungi intercepted on imported soybean seed. Indian Phytopath. 22:327–330.

Myrothecium roridum, Colletotrichum dematium var. *truncata,* and *Aspergillus flavus* are likely to be a potential danger to soybean crop and consequently a threat to soybean industry in India. The fungal infection was found to be seedborne. Treatment of seed against some internally seedborne pathogens is not always effective and, in others, it may not be feasible to treat bulk supplies effectively. The techniques discussed here, though adequate in detecting infections, need further standardization.

1196. LAM-SANCHEZ, A. 1968. Studies on the sources and inheritance of resistance to *Phytophthora megasperma* var. *sojae* in soybean. Diss. Abstr. 28:4836.

All soybean varieties tested, with resistance to *Phytophthora megasperma* var. *sojae,* possessed the same dominant gene Ps which is present in cultivar Mukden. No evidence of modifier genes was obtained.

1197. LANIER, T. J. 1958. The establishment of the soybean cyst nematode identification laboratory at Memphis, Tennessee. Proc. Assoc. So. Agr. Workers 55th Ann. Conv., p. 116.

The nematode was found in North Carolina in 1954. In 1956 it was found in soybean-producing area along the Mississippi river. Soybean nematode identification laboratory was set up in 1957 in Memphis. This paper gives a summary of techniques used in the laboratory.

1198. LAPIS, D. B. 1972. The role of red spider mites on the infection of soybean with *Pseudomonas glycinea* Coerper. Philipp. Phytopath. 8:66–71.

Soybean plants infested with mites (*Tetranychus telarius*) show resistance or immunity to *Pseudomonas glycinea* infection. The plant reaction intensified both with increased number of mites and longer exposure of plants to them prior to infection with *P. glycinea.*

1199. LARSH, H. W. 1944. Summary report of plant diseases in Oklahoma, 1943. Plant Dis. Reptr. Suppl. 149:317–326.

Reporting occurrence of wilt caused by *Fusarium oxysporum* f. *tracheiphilum, Nematospora coryli, Cercospora sojina, Diaporthe phaseolorum* var. *sojae, Glomerella glycines, Macrophomina phaseoli* (= *M. phaseolina*), *Pseudomonas glycinea, Xanthomonas phaseoli* var. *sojense,* and mosaic virus.

1200. LARSH, H. W. 1944. Soybean diseases in Arkansas. Plant Dis. Reptr. 28:870–871.

Records the occurrence of *Pseudomonas glycinea, Xanthomonas phaseoli* var. *sojense, Cercospora sojina, Alternaria* sp. (leaf spot), *Septoria glycines,* Fusarium blight (*F. oxysporum* f. *tracheiphilum*), *Peronospora manshurica, Sclerotium bataticola* (= *Macrophomina phaseolina*), *S. rolfsii,* and mosaic virus.

1201. LARSH, H. W. 1944. Diseases observed on soybeans in Arkansas. Plant Dis. Reptr. 28:956–957.

Records prevalence of the following pathogens on soybean: *Xanthomonas phaseoli* var. *sojense, Pseudomonas tabaci, Diaporthe phaseolorum* var. *sojae, Glomerella glycines, Peronospora manshurica, Cercospora sojina, Sclerotium bataticola* (= *Macrophomina phaseolina*),

Sclerotium rolfsii, Alternaria leaf spot, mosaic virus, and tobacco ring spot virus.

1202. LARSH, H. W. 1944. Diseases reported on soybeans in Oklahoma. Plant Dis. Reptr. 28:1010.

Records the prevalence of Diaporthe pod and stem blight, *Cercospora sojina, Sclerotium bataticola* (= *Macrophomina phaseolina*), *Nematospora coryli,* mosaic virus, *Pseudomonas tabaci,* and *Xanthomonas phaseoli* var. *sojense.*

1203. LARSH, H. W. 1944. Diseases observed on soybeans in Arkansas. Plant Dis. Reptr. 28:1125–1126.

Records the prevalence of *Xanthomonas phaseoli* var. *sojense, Pseudomonas tabaci, Glomerella glycines, Cercospora sojina, Diaporthe phaseolorum* var. *sojae, Sclerotium bataticola* (= *Macrophomina phaseolina*).

1204. LAURENCE, J. A., and B. W. KENNEDY. 1974. Population changes of *Pseudomonas glycinea* on germinating soybean seeds. Phytopathology 64:1470–1471.

Significantly larger populations of two races of *Pseudomonas glycinea* developed on germinating seeds of a susceptible cultivar but not on a resistant soybean cultivar, thus demonstrating preemergence host-pathogen specificity. Host emergence was reduced in some race-cultivar combinations in the greenhouse but not in the field.

1204a. LAURENCE, J. A., and B. W. KENNEDY. 1974. Radicle browning reaction of soybean seedlings inoculated with *Pseudomonas glycinea.* Proc. Amer. Phytopath. Soc. 1:73. (Abstr.)

Seeds of 13 soybean cultivars were surface disinfested, incubated 24 hr. at 27 C on moist sterile filter paper, then inoculated with approximately 5×10^5 cells/seed of one of three races of *Pseudomonas glycinea.* Leaf reactions were determined simultaneously in greenhouse pathogenicity tests. Seedlings of cultivars resistant to race 1 in greenhouse studies developed brown hypersensitive-like lesions on the radicles 24–48 hr. after inoculation. Lesions did not develop on radicles of cultivars susceptible to races 1, 2, or 5. Radicle browning did not develop on seedlings of the cultivar resistant to race 5, and so the reaction may be limited in occurrence to cultivars resistant to race 1. The similarity of rapid radicle browning to hypersensitive resistant leaf reactions requires further investigation.

1205. LAUTZ, W. H. 1959. Increase of *Belonolaimus longicaudatus* on various plant species in artificially inoculated soil. Plant Dis. Reptr. 43:48–50.

Population of *Belonolaimus longicaudatus* increased on CNS 24 soybean in the greenhouse.

1206. LAVIOLETTE, F. A. 1967. How to control soybean diseases. Farm Technol. 23(1):38–40a.

A popular article describing symptoms and control measures of bacterial blight, bacterial pustule, wildfire, bacterial wilts, *Rhizobium*-induced chlorosis, downy mildew, target spot, frog-eye leaf spot, Phytophthora root and stem rot, stem canker, pod and stem blight, Rhizoctonia rot, purple seed stain, mosaic, bud blight, yellow mosaic, root-knot nematode, cyst nematode, sting nematode, and nutritional diseases.

1207. LAVIOLETTE, F. A., K. L. ATHOW, A. H. PROBST, and J. R. WILCOX. 1970. Effect of bacterial pustule on yield of soybeans. Crop Sci. 10:150–151.

Nine pairs of susceptible and resistant lines of soybeans representing early, medium, and late maturity were compared for yield under heavy artificial infection with bacterial pustule caused by *Xanthomonas phaseoli* var. *sojense.* Comparisons were made for 1966 through 1968 at Worthington, Ind. All plots were inoculated three times and severe infection resulted on all susceptible lines. The susceptible lines yielded slightly but nonsignificantly higher than the resistant counterparts. Since infection was heavier than normally occurs in the Midwest, importance of bacterial pustule on yield in this area is questionable.

1208. LAVIOLETTE, F. A., K. L. ATHOW, A. H. PROBST, J. R. WILCOX, and T. S. ABNEY. 1970. Effect of bacterial pustule and frogeye leaf spot on yield of Clark soybean. Crop Sci. 10:418–419.

The effect of bacterial pustule (*Xanthomonas phaseoli* var. *sojense*) and frog-eye leaf spot (*Cercospora sojina*) diseases on the seed yield of Clark soybeans was studied with artificial inoculation at Lafayette, Ind., from 1966–1968. Good initial bacterial pustule infection resulted in only mild disease and no significant differences in yield between inoculated and noninoculated plots. Frog-eye infection was severe in 2 of the 3 years and diseased plots were 17 and 21% lower in yield. We concluded that bacterial pustule resistance is nonessential in the area because the disease failed to develop sufficiently to affect yield even with good initial infection. Resistance to frog-eye leaf spot is desirable to prevent reestablishment of a potentially destructive disease.

1209. LAVIOLETTE, F. A., and K. L. ATHOW. 1971. Relationship of age of soybean seedlings and inoculum to infection by *Pythium ultimum.* Phytopathology 61:439–440.

The relationship of age of plant and inoculum to infection by *Pythium ultimum* was studied by inserting 4- to 20-day-old mycelium into hypocotyl of soybean seedlings 8–14 days of age. Nearly 100% seedlings 8–10 days of age were killed with 4- to 8-day-old mycelium. The percentage killed progessively decreased with increased age of mycelium and/or increased age of plant.

1210. LAVIOLETTE, F. A., and K. L. ATHOW.

1971. Longevity of tobacco ring spot virus in soybean seed. Phytopathology 61:755.

Soybean seed, cultivar Harosoy, harvested from tobacco ring spot virus (TRSV) infected plants, was stored at room temperature in the laboratory and at 1–2 C in a cold room. Germination of seed stored in the laboratory was reduced after 24 months and declined sharply after 42 months. Germination of seed stored in the cold room remained unchanged for 42 months as did percentage of seed infected with TRSV under both storage conditions. The possibility of disseminating the virus in infected seed is mentioned.

1211. LAVIOLETTE, F. A., and K. L. ATHOW. 1972. *Cercospora kikuchii* infection of soybean as affected by stage of plant development. Phytopathology 62: 771. (Abstr.)

Purple seed stain of soybean caused by the fungus *Cercospora kikuchii* occurs in all soybean-producing areas and is one cause of lowered seed quality. Seed germination is not greatly reduced, but infected seed frequently produces weak seedlings and less productive plants. Discoloration of the seed coat also lowers seed grade and is objectionable in the export market. Inoculum was grown on V8 juice-agar plates, and a spore suspension was sprayed to thoroughly wet the plants. To determine at what stage of plant growth infection occurred, field plots were inoculated 1–9 times at weekly intervals, beginning at early bloom. Results indicate that one or two well-timed inoculations during the full flower period gave maximum infection. More than 90% of seed from most susceptible cultivars were infected, whereas less than 1% of seed from most resistant lines were infected.

1212. LAVIOLETTE, F. A., T. S. ABNEY, J. R. WILCOX, and K. L. ATHOW. 1973. Indiana soybean disease and crop condition survey. Indiana Agr. Expt. Sta. Bull. SB 22, September 1973. 8 pp.

Of the 10 pathogens commonly reported on soybean in Indiana, *Septoria glycines, Peronospora manshurica,* and *Pseudomonas glycinea* were most prevalent in 1973. *Xanthomonas phaseoli* var. *sojense, Phytophthora megasperma* var. *sojae, Cephalosporium gregatum,* tobacco ring spot virus, mosaic virus, Rhizoctonia root rot, and *Diaporthe phaseolorum* var. *caulivora* were prevalent, in that order.

1213. LAVROVF, N. N. 1932. Key for the identification of vegetable parasites of cultivated and wild useful plants of Siberia. I. Field, kitchen garden, cucurbitaceous and technically useful crops [in Russian]. Tomsk, Izdatal 'stroo "Kusuch." 148 pp.

A virus of oats is transmitted to soybean through soil.

1214. LEAKEY, C. L. A. 1964. *Dactuliophora,* a new genus of *Mycelia sterilia* from tropical Africa. Trans. Brit. Mycol. Soc. 47:341–350.

Dactuliophora glycines Leakey on *Glycine max* and *G. javanica* is reported in Northern Rhodesia. Leaf spots are large, on both sides of the leaf, and often spreading to the leaf margins and becoming confluent. Individual spots are more or less circular, up to 4 cm diameter, very broadly and rather indistinctly zonate. Appearance is similar on each side. Mycelium immersed, colorless, diffuse throughout the host tissues within the spot, aggregated in plectenchymic masses beneath the sclerotiophores. No means of reproduction other than by sclerotia have been seen. Mycelium of the fungus immersed, colorless, aggregates in mass beneath the sclerotiophore, sclerotiophore erumpent, persistent in host. Sclerotia scattered on lower surface of leaf spots on paler areas only, more or less spherical, 125–250 μ in diameter, dark brown externally with external cells 8–12 μ in diameter, colorless and undifferentiated internally. Sclerotial setae dematiaceous, 15–25 $\times$ 4–5 μ at base tapering to a blunt tip, 0–1 septate.

1215. LE BEAU, F. J. 1947. A virus-induced top necrosis in beans. Phytopathology 37:434. (Abstr.)

A virus which causes severe systemic necrosis of beans (*Phaseolus vulgaris*) can infect soybeans by artificial inoculation. Its thermal inactivation point suggests a relationship with that responsible for soybean bud blight (tobacco ring spot virus).

1216. LEBEN, C., and G. C. DRAFT. 1966. Migration of bacteria on seedling plants. Canad. J. Microbiol. 12: 1119–1123.

Cucumber, maize, and soybean seeds were dipped in dilute suspensions of cells of isolates A169 or A180, culturally distinctive marker bacteria originally isolated from cucumber leaves. Seeds were planted in an autoclaved rooting medium. Relative humidity of air around shoots was greater than 90%. Distribution of the marker bacteria and of other bacteria normally carried by seed (termed normal bacteria) was characteristic on shoots of a given plant species, as determined by printing shoot parts on agar. Bacteria occurred uniformly on prints of all parts of cucumber shoots. On prints of maize shoots, distribution was patchy, with large areas of leaves apparently carrying no bacteria. Bacteria were confined mostly to the lower stem of soybean. On prints of shoots of plants from seeds treated with a marker organism, usually the marker and normal bacteria were intermixed. Marker and normal bacteria were detected in abundance on roots of all three plant species. When marker bacteria were placed on loops of string around stems of cucumber seedlings, the markers did not migrate to other parts of plant.

1217. LEBEN, C., G. C. DAFT, and A. F. SCHMITTHENNER. 1968. Bacterial blight of soybeans: popula-

tion levels of *Pseudomonas glycinea* in relation to symptom development. Phytopathology 58:1143–1146.

Populations of *Pseudomonas glycinea* were assayed on agar after grinding unifoliolate leaves of two soybean cultivars 1, 2, 3, 4, 7, 11, 15, 22, and 29 days after wound inoculation with about 1.2×10^6 viable cells (the "X" conc.) of isolate 40. Substantial numbers of the pathogen were present before symptoms appeared, maximum populations were found between 7 and 15 days, and populations declined as lesions became necrotic and as leaves dried. Symptom development was slower and peak populations were lower and reached later with the 0.01X inoculum conc.; however, between 15 and 29 days, 0.01X and X inocula resulted in the same population levels. After gentle washing of leaves 2, 4, and 10 days after inoculation (isolate 40, X conc.), the highest numbers of bacteria were found in the wash water at 10 days. Proportionately more of the total bacteria were found (in washing plus ground leaves) at 4 days (start of water-soaking) than at 10 days, when lesions were necrotic and becoming dry.

1218. LEBEN, C., V. RUSCH, and A. F. SCHMITTHENNER. 1968. The colonization of soybean buds by *Pseudomonas glycinea* and other bacteria. Phytopathology 58:1677–1681.

Soybean seed inoculated with *Pseudomonas glycinea* and planted in chambers (isolators) with a humid atmosphere produced healthy and diseased seedlings. The pathogen was recovered from healthy seedlings and from healthy parts of diseased seedlings. Seedlings were inoculated with *P. glycinea* in water drops covering young buds, and buds were assayed afterward for the pathogen. *P. glycinea* multiplied in some buds which showed no evidence of disease. Other nonidentified bacteria also colonized buds. Bacteria were readily seen on bud parts as individuals and in colonies. *P. glycinea* was indicated to be in buds of mature soybean plants in the field. In nature this pathogen may have a resident phase in buds and buds may be a continual source of inoculum.

1219. LEBEN, C., and T. D. MILLER. 1972. A pathogenic bacterium from healthy soybean plants. Phytopathology 62:771. (Abstr.)

An abstract of entry 1221.

1220. LEBEN, C. 1972. The development of a selective medium for *Pseudomonas glycinea.* Phytopathology 62: 674–676.

The basal medium, designated TTCC, contained the following ingredients in g/liter: peptone 10; casein hydrolysate 1; glucose 5; cycloheximide 0.05; triphenyl tetrazolium HCl 0.05; boric acid 1; and agar 20. Five ml of an autoclaved stock solution of tetrazolium salt was added to warm, autoclaved medium prior to pouring into plates. Boric acid in the basal medium was responsible for selectivity.

1221. LEBEN, C., and T. D. MILLER. 1973. A pathogenic *Pseudomonas* from healthy field-grown soybean plants. Phytopathology 63:1464–1467.

Bacteria resembling *Pseudomonas glycinea* in culture were isolated from buds, pollinated flowers, and young pods of healthy field soybean plants. These organisms, designated as FD, initiated a resistance response on leaves of soybean and other beans, and they reduced emergence and produced dwarfed soybean seedlings following hypocotyl or cotyledon inoculation. FD bacteria resembled isolates of *Pseudomonas syringe* on the basis of pathogenicity and laboratory tests. It is suggested that these organisms colonize the aerial parts of soybean plants. Damage likely would occur only when they are introduced into seedling wounds.

1221a. LEBEN, C. 1974. Control of bacterial blight on soybean seedlings by treating seed with oxytetracycline hydrochloride. Proc. Amer. Phytopath. Soc. 1:92. (Abstr.)

Soybean seed, naturally carrying *Pseudomonas glycinea,* was treated in 100 g lots with test preparations in 3 ml water or 0.5 ml of 70% superior oil. Seed was rolled with test preparations 15 min.; that treated with water was dried before planting. After treatment, *P. glycinea* was detected by germinating seed 3 days in moist vermiculite, wounding partly germinated seedlings by shaking in water containing sand, and replanting in the vermiculite. Typical blight lesions were produced on cotyledons of control seedlings emerging in water-saturated air. Oxytetracycline hydrochloride in water (a solution) or the oil (a suspension) at 10 mg/seed lot gave nearly complete disease control with five seed sources; this was in contrast to 10% to > 90% diseased seedlings in control lots. At 10 mg/lot, cotyledons were yellowed but seed germination was not reduced; at 20 mg/lot, yellowing was intensified and germination was reduced. Field tests are in progress.

1222. LEE, F. N., and H. J. WALTER. 1970. A virus isolated from *Desmodium* related to bean pod mottle virus. Phytopathology 60:585. (Abstr.)

Bean pod mottle virus isolated from *Desmodium paniculatum* produced systemic infection in soybeans.

1222a. LEE, R. F., L. B. JOHNSON, and C. L. NIBLETT. 1974. Aspartate transcarbamylase activity in green leaves of virus-infected cowpea and soybean. Proc. Amer. Phytopath. Soc. 1:127. (Abstr.)

Aspartate transcarbamylase (ATCase) catalyzes the first reaction unique to de novo pyrimidine synthesis, condensing aspartic acid and carbamyl phosphate to ureidosuccinate. We have previously shown increased ATCase activity in etiolated cowpea hypocotyls infected with cowpea mosaic virus (CPMV). Since etiolated tissues represent an abnormal condition, we assayed ATCase activity in healthy and virus-infected green leaves. Low

molecular weight compounds which interfered with the ATCase assay were removed by chromatography on Sephadex G-75. In cowpeas infected with CPMV, ATCase activity increased 3.4-fold over healthy values by 12 days after inoculation, while buffer-soluble protein increased 1.3-fold. CPMV concentration, as assayed by infectivity, was maximal 9 days after inoculation. In soybeans infected with tobacco ring spot virus (TRSV), ATCase activity increased 4-fold over healthy tissues by 9 days after inoculation, while buffer-soluble protein increased 1.6-fold. TRSV concentration was maximal 8 days after inoculation. The reaction product was identified as ureidosuccinate by thin layer chromatography. These data indicate that ATCase activity increases during replication of CPMV or TRSV in green cowpea and soybean leaves, respectively.

1223. LEE, Y., and J. P. ROSS. 1971. Study on interaction of soybean mosaic and bean pod mottle viruses in soybean. Phytopathology 61:900. (Abstr.)

An abstract of entry 1224.

1224. LEE, Y., and J. P. ROSS. 1972. Top necrosis and cellular changes in soybean doubly infected by soybean mosaic and bean pod mottle viruses. Phytopathology 62: 839–845.

Soybean plants inoculated with soybean mosaic virus (SMV) 1 week prior to bean pod mottle virus (BPMV) inoculation often develop top necrosis. Conditions favorable for top necrosis of doubly infected plants included diurnally fluctuating (27–21 C) and constant (27 C) temperatures, inoculation of seedlings rather than older plants, and use of inoculum containing high SMV titers. Concentrations of SMV were significantly higher in doubly infected plants than those in singly infected plants 3 and 4 weeks after SMV inoculation as determined by virus particle counts and by serological and infectivity dilution end counts. Growth of SMV-infected and doubly infected plants was not increased by applications of gibberellic acid, whereas growth of BPMV-infected and healthy plants was increased. No consistent differences in number or size of SMV inclusion bodies between singly and doubly infected plants were detected by either light or EM observations. Inclusions of SMV and BPMV-like particles were found in the same cells. Starch granules were more numerous and larger in healthy than in singly or doubly infected plants. Osmiophilic globules appeared and increased in size in necrotic areas of doubly infected plants.

1225. LEE, Y., and J. P. ROSS. 1972. Nature of the inhibitory effect of bean pod mottle virus on local lesion production by soybean mosaic virus on bean. Phytopathology 62:887–889.

Bean pod mottle virus (BPMV) causes partial inhibition of local lesion production by soybean mosaic virus (SMV) when bean leaves are inoculated with mixtures of the two viruses. Neither zones of SMV lesion inhibition nor a reduction in SMV lesion size was induced by BPMV. The effect of inactivated and infective BPMV and the sequence of virus inoculation on SMV lesion inhibition were studied. Infective BPMV caused more inhibition than BPMV inactivated by heat or ultraviolet irradiation. Sequential inoculations with the two viruses separated by various time intervals indicated that maximum inhibition of SMV lesions occurred when inoculations were simultaneous; SMV lesion inhibition was sharply reduced during the first-minute interval between inoculations. Inhibition of SMV lesions by BPMV infection may be due to the unilateral competition for infectible sites.

1226. LEFFLER, H. R., and J. H. CHERRY. 1974. Destruction of enzymatic activity of corn and soybean leaves exposed to ozone. Canad. J. Bot. 52:1233–1238.

Experiments were conducted to determine the effects of a single ozone exposure on selected enzymatic activities and chlorophyll content of corn and soybean seedlings. Both nitrate reductase activity and chlorophyll content of the seedlings were found to be quite sensitive to ozonation and were seen to decrease as much as 50% after exposure to 80 pphm ozone. After exposure to lower levels of ozone, less-pronounced decreases were observed. Nitrate reductase activity was reduced only after exposure of seedling leaf tissues to high concentrations of ozone. These results are discussed in relation to the concept of a two-phase response to oxidant exposure. The first phase is at the chloroplast level and is quite sensitive to low as well as high concentrations of ozone; the second is at the cellular level and is relatively resistant to all but the highest ozone concentrations.

1227. LEHMAN, P. S. 1969. Hatching responses of *Heterodera glycines* to hydrogen ion concentrations and inorganic ions. J. Nematol. 1:14–15. (Abstr.)

An abstract of entry 1229.

1228. LEHMAN, P. S., K. R. BARKER, and D. HUISINGH. 1970. The effect of races of *Heterodera glycines* on nodulation and nitrogen fixation in soybeans. Phytopathology 60:1299–1300. (Abstr.)

An abstract of entry 1230.

1229. LEHMAN, P. S., K. R. BARKER, and D. HUISINGH. 1971. Effects of pH and inorganic ions on emergence of *Heterodera glycines*. Nematologica 17: 467–473.

Experiments were conducted to determine effects of pH and inorganic ions on emergence of the soybean-cyst nematode *Heterodera glycines*. Emergence from cysts without egg masses was greatest at pH 3.5 but was depressed at pH 5.5. Hatching from egg masses was insensitive to pH. The influence of inorganic ions on emergence was determined in a factorial experiment in

which the cations NH_4^+, Ca^{++} were used in combination with each of the anions NO_3^-, SO_4^-, and Cl^-. Compounds containing NH_4^+ or NO_3^- inhibited emergence as compared to phthalate buffer control. $CaSO_4$, on the other hand, was stimulatory. Experimental results demonstrated the necessity of controlling pH in emergence experiments and suggested that inorganic ions applied as fertilizers may influence the inoculum potential of the soybean-cyst nematode.

1230. LEHMAN, P. S., D. HUISINGH, and K. R. BARKER. 1971. The influence of races of *Heterodera glycines* on nodulation and nitrogen-fixing capacity of soybean. Phytopathology 61:1239–1244.

Three races of *Heterodera glycines* were compared for their effects on nodulation and nitrogen (N)-fixing capacity of Lee soybean. Alteration in N-fixing capacity was quantitatively determined, using an acetylene-ethylene gas chromatographic assay. Inoculum densities of 100, 200, and 400 crushed cysts/pot of race 1 of *H. glycines* plus *Rhizobium japonicum* caused a significant decrease in nodules per gram of root tissue and N-fixing capacity per plant as compared with *R. japonicum* check plants. The same inoculum densities of races 2 and 4 did not decrease nodules per gram of root tissue or N-fixing capacity per plant. Nodule number and nodule weight were inversely correlated with increasing densities of race 1. Infection by race 1 initially increased nodular efficiency of the few nodules present; i.e., increased N-fixing capacity per milligram fresh weight of nodules. However, as race 1 multiplied, nodular efficiency and total N-fixing capacity declined. Race 1 caused severe chlorosis of soybean, whereas races 2 and 4 did not. This was correlated with the greater effectiveness of race 1 to decrease nodulation and N-fixing capacity.

1231. LEHMAN, S. G. 1922. Pod and stem blight of soybean. J. Elisha Mitchell Sci. Soc. 38:13.

An abstract of entry 1232.

1232. LEHMAN, S. G. 1923. Pod and stem blight of soybean. Ann. Missouri Bot. Gard. 10:119–169.

First detailed report of pod and stem blight. The causal organism is described as *Diaporthe sojae* (= *D. phaseolorum* var. *sojae*) perfect stage of *Phomopsis sojae*. Morphology of the fungus is described and illustrated. The disease occurs on pods, stems, and infrequently on leaves, and causes premature death of the plant, inhibition of seed development, and decay of seed. Presence of the fungus is manifested by pycnidia distributed over the stem and pod in a linear order. Perithecia were never found in nature but developed in cultures of two strains from pod. Young seedlings may die by growth of the fungus from seed coat to hypocotyls. The fungus overwinters on diseased stems and seeds. Infection and dissemination during the growing season are strongly dependent on high relative humidity. Conidia of the fungus germinate in nutrient solution over a wide pH range. Light is essential for pycnidia production in culture.

1233. LEHMAN, S. G., and F. A. WOLF. 1924. A new downy mildew of soybeans. J. Elisha Mitchell Sci. Soc. 39:164–169.

First detailed report of occurrence of new downy mildew disease in United States. The causal fungus is named as *Peronospora sojae* (= *P. manshurica*). Symptoms are confined to leaves. They appear as indefinite chlorotic areas which change to grayish-brown, irregular lesions with well-defined brown borders. A dense grayish coating of conidiophores may cover the lower surface of the lesions. Morphology and taxonomy of causal fungus are described and illustrated.

1234. LEHMAN, S. G., and F. A. WOLF. 1926. Pythium root rot of soybean. J. Agr. Res. 33:375–380.

First report of Pythium root rot in the United States and the world. The causal fungus was identified as *P. debaryanum*. The possibility of *P. ultimum* was excluded because this fungus had been reported as saprophyte. Affected plants have decaying roots and basal portion of stem. The lesions extend entirely around the stem. Invasion occurs at ground level, and the fungus moves up and downward. Freshly invaded tissues are translucent, older lesions brown, necrotic and involved in wet rot. When plants are removed from the soil the cortical tissues of larger roots are badly disintegrated and fall away, exposing the central woody cylinder. Morphology of the fungus is described and illustrated.

1235. LEHMAN, S. G., and F. A. WOLF. 1926. Soybean anthracnose. J. Agr. Res. 33:381–390.

The ascogenous stage of *Colletotrichum glycines* (= *C. dematium* var. *truncata*) was found on diseased stem of soybean and also in culture. It differs from *Glomerella cingulata* in morphology and was named *G. glycines*. The morphology and life cycle of the fungus are described and illustrated. The disease affects stems and pods and is characterized by presence of numerous black acervuli, uniformly scattered over the surface of affected parts. Causes premature death of the plant and failure of the pods to fill. The organism is seedborne and exists as mycelium within the seed with spores adhering to the exterior. [Later studies (entry 1262) showed that *G. glycines* is not the perfect stage of *C. glycines* (= *C. dematium* f. *truncata*)].

1236. LEHMAN, S. G. 1928. Frogeye leaf spot of soybean caused by *Cercospora daizu* Miura. J. Agr. Res. 36: 811–833.

First detailed report of the disease in United States. The causal organism is identified as *C. daizu* (= *C. sojina*). It is primarily a foliage disease. Lesions are never ob-

served on pod, rarely on stem. Leaf spots are generally discrete, appearing on upper surface as minute, reddish-brown spots which increase in size; a narrow, reddish-brown band surrounds the central light-brown area. Symptoms of leaf spot may vary from one cultivar to another. The disease is potentially capable of causing great reduction in seed yields. Greatest injury is done to late-maturing cultivars, whereas early-maturing cultivars escape serious damage. The fungus causes pathological changes in host by producing substances that act in advance of hyphal growth. The host cells first show change in staining reaction followed by protoplasmic disorganization and complete collapse of affected cells. Fungus overwinters on diseased leaves, stems, and seeds. Control measures include plowing under of crop residue, 2–3-year rotation and use of early-maturing and resistant cultivars.

1237. LEHMAN, S. G. 1929. Studies on bacterial pustule of soybean. Phytopathology 19:96. (Abstr.)

An abstract of entry 1240.

1238. LEHMAN, S. G., and R. F. POOLE. 1929. Research in botany. North Carolina Agr. Expt. Sta. Ann. Rpt. 51, pp. 59–67.

Cercospora daizu (=*C. sojina*) may remain alive on moist diseased leaves until next planting season, but is unable to survive disintegration of the leaves. Seed treatment proved unavailing. Good control of downy mildew was obtained by seed treatment. The bacterial pustule organism (*Xanthomonas phaseoli* var. *sojense*) was found to remain viable in dry diseased leaves as well as partially decayed leaves left out-of-doors from one season to another. Columbia cultivar of soybean was practically immune. Good control of *Peronospora manshurica* in Herman and Laredo soybean cultivars was obtained by seed treatment with semsan, upsulun, and $HgCl_2$.

1239. LEHMAN, S. G., and J. W. WOODSIDE. 1929. Varietal resistance of soybean to the bacterial pustule disease. J. Agr. Res. 39:795–805.

Fifty-five soybean cultivars are listed, showing their reaction to bacterial pustule disease. Columbia cultivar possesses greatest resistance. Other highly resistant cultivars include Mandarin and Dominion.

1240. LEHMAN, S. G. 1931. Observations and experiments relating to the bacterial pustule disease of soybean. J. Elisha Mitchell Sci. Soc. 46:179–189.

Bacterium phaseoli var. *sojense* (= *Xanthomonas phaseoli* var. *sojense*) was isolated from lesions on soybean showing no sign of pustular development, which was believed not a necessary concomitant of the infection. Absence of pustules from the lesions is not conclusive of absence of bacterial pustule disease. Infection was heavier on plants kept at a constant temperature of 30–33 C than on those exposed to fluctuations between 22 and 30 C. Very few lesions developed when temperatures fluctuated between 25 C day and 15 C night. The disease is dependent upon temperatures during infection and incubation period. Young leaves are most susceptible. The leaves become rapidly resistant with increased maturity of leaf. The bacterium can survive at least 3 months on decaying leaves and 9 months on dry leaves.

1241. LEHMAN, S. G. 1931. Powdery mildew of soybean. J. Elisha Mitchell Sci. Soc. 46:190–195.

The causal fungus was identified as *Erysiphe polygoni*, but the strain from garden bean was unable to infect soybeans. The symptoms appear first on upper leaf surface as dirty gray spots which in time become covered with a white, powdery mass with reddening of underlying tissues. The fungal growth is confined to upper side of infected leaves.

1242. LEHMAN, S. G. 1934. Frog-eye (*Cercospora daizu* Miura) on stems, pods, and seeds of soybean, and the relation of these infections to recurrence of the disease. J. Agr. Res. 48:131–147.

The fungus was frequently observed on stems, pods, and seeds of soybeans. In stems the parasite is chiefly confined to the cortex and the injury to phloem and cambium is usually due to diffusion of the toxic substances from the necrotic cortex. In pods the mycelium penetrates through the pod wall, entering the thin white membranes lining the pod and closely investing the seed. Growth of the fungus is usually superficial on the seeds and is easily controlled by seed disinfectants. The infection carries over winter on diseased leaves and stems, but ploughing-in of infected stubbles is not practicable in preventing the disease. Further spread of the disease may be prevented by use of healthy seeds.

1243. LEHMAN, S. G. 1942. Notes on plant diseases in North Carolina in 1941: Soybean. Plant Dis. Reptr. 26: 111.

Records the prevalence of *Phytomonas* (= *Xanthomonas*) *phaseoli* var. *sojense*, *Cercospora daizu* (= *C. sojina*), and *Peronospora sojae* (= *P. manshurica*).

1244. LEHMAN, S. G. 1943. Occurrence of yeast spot on soybean in North Carolina. Plant Dis. Reptr. 27:602.

Nematospora phaseoli ? or *N. coryli* ? was isolated from discolored soybean seeds. Direct examination of discolored seeds showed presence of ascospores of a yeast. On developing green soybean seeds the infected tissues vary in appearance from a slightly yellowish discoloration to very obvious brown discoloration, covering as much as one-fourth of the seeds. It is thought that the bugs resembling green soldier bugs serve as inoculating agent.

1245. LEHMAN, S. G. 1944. Dusting soybean for control of bacterial pustule. Phytopathology 34:1007–1008. (Abstr.)

Little information is available on the effect of spraying or dusting soybean plants to control disease. In 1944 a field experiment was set up to determine how much reduction of bacterial pustule (*Xanthomonas phaseoli sojense*) may be expected from dusting the plants with fungicides. Dust preparations used were: (a) 325-mesh sulfur, (b) copper-talc containing 6% metallic Cu, and (c) copper-sulfur containing 6% metallic Cu. Half the dusted and control plots were inoculated by spraying with *X. phaseoli sojense*. Sulfur dust failed to reduce bacterial pustule. The copper-talc and copper-sulfur dusts were more effective. Cultivar Tokio had 62 and 90% infected leaves, respectively, in noninoculated and inoculated control plots and 33 and 51% on correspondent plots dusted with copper-talc. More obvious disease reduction was observed in number of infections per leaf. Noninoculated and inoculated nondusted plants showed respectively 12 and 60 infections per leaf, but only 3 and 12 infections per leaf were found on correspondent plants dusted with copper-talc. On the more susceptible Herman cultivar 30 and 100 infections per leaf were found, respectively, on noninoculated and inoculated nondusted plants, and only 6 and 15 infections per leaf occurred on correspondent dusted plants. The copper-sulfur dust gave disease reductions closely paralleling those of copper-talc.

1246. LEHMAN, S. G. 1945. Three important foliage diseases of soybeans. North Carolina Agr. Expt. Sta., Res. and Farming 4(1):4–5.

A popular account of bacterial blight, bacterial pustule, and brown spot. Reaction of soybean cultivars grown in North Carolina to bacterial pustule is given.

1247. LEHMAN, S. G. 1946. Control of bacterial pustule of soybean by dusting. Phytopathology 36:405. (Abstr.)

Favorable results were obtained from an experiment designed to control bacterial pustule of soybean by dusting growing plants with fungicides. The experiment was repeated with amplification in 1945. Dust preparations used were: (1) copper-clay containing 7% metallic Cu from Tennessee 34, (2) copper-sulfur having 7% metallic Cu from Tennessee 34, (3) copper-talc containing 7% Cu from copper compound A, (4) 20% fermate in pyrox talc, (5) 20% zerlate in pyrox talc, (6) 325-mesh sulfur, (7) 10% fermate in S, (8) 5% DDT in S. Six applications of each dust were made. Only dusts containing Cu reduced bacterial pustule. In control rows not dusted, less than 5% of the leaves were entirely free of disease. On the remaining 95% damage ranged from slight to severe. In rows dusted with Cu, 37 to 74% of the leaves were entirely free of disease; remaining leaves showed little injury, few or none being severely damaged. Plots dusted with Cu yielded 4.9 bu./acre more than plots not dusted. Sulfur dust reduced yields about as much as Cu increased them.

1248. LEHMAN, S. G. 1947. Powdery mildew of soybean. Phytopathology 37:434. (Abstr.)

Powdery mildew has on several occasions been reported on soybean in Europe and America. The causal fungus when named has been assigned to genus *Erysiphe*. In 1936 and 1944, powdery mildew was found in the pathology greenhouse at Raleigh, N.C. Perithecia present were of genus *Microsphaera*. In 1944, powdery mildew was collected by Prince in western North Carolina and reported as *Erysiphe polygoni*. When these specimens were more carefully examined, perithecia of genus *Microsphaera* were found. In September 1945, *Microsphaera* was found on soybeans at several locations in eastern North Carolina. The disease was present in the same areas in 1946. The fungus produces short, club-shaped conidiophores. Perithecia are dark brown to black, subspherical, and have an average of about 20 appendages. Appendages are two to three times as long as the diameter of the perithecium, and are three to five times dichotomously branched. In field and greenhouse inoculations the following cultivars were susceptible: Armredo, Cherokee, Herman, Ogden, Ralsoy, Seminole, Tokio, and a number of hybrid selections. Biloxi, CNS, Haberlandt, Roanoke, Rokusun, S-100, Volstate, and Woods Yellow, and several hybrid selections have remained free of mildew.

1249. LEHMAN, S. G., and J. H. GRAHAM. 1948. Results from dusting soybeans with copper in 1947. Phytopathology 38:570. (Abstr.)

Three cultivars of soybeans, Ralsoy, Ogden, and Roanoke, were dusted six times at approximately 8-day intervals with a mixture consisting of tribasic $CuSO_4$ equivalent to 7% metallic Cu, 10% wheat flour, 3% DDT, and 90% Cherokee clay. Control plots received the same dust devoid of Cu. Only light to moderate damage from bacterial diseases occurred during the summer. As the plants reached the peak of the vegetative period, severe damage occurred on leaves from a disease not fully identified as to cause. Disease scores calculated on October 1, 5 weeks after the final dust application, showed 27.6% of diseased leaf area on control plots. On plots receiving 30, 60, and 90 lb. of Cu dust per acre at each application, diseased leaf area was reduced to 19, 12, and 11%, respectively. Mean yield of the three cultivars on the control plots was 27 bu./acre. Plots receiving 30, 60, and 90 lb. of Cu dust yielded 32.5, 32.5, and 32.7 bu., respectively. A yield increase of 5.5 bu./acre resulted from use of Cu dust. Least increase required for significance at the 1% level was 5.1 bu.

1250. LEHMAN, S. G., and J. H. GRAHAM. 1948. Soybean seed treatment tests in North Carolina in 1947. Phytopathology 38:571. (Abstr.)

After preliminary germination tests of treated and nontreated soybean seed in steamed sand in the greenhouse, 10 lots were selected for field testing. These included

paired lots grown from the same parental seed in widely separated areas, McCullers and Plymouth, where weather conditions differed markedly during the ripening and harvesting period. Three aliquots of each lot were planted, one nontreated, one dusted with arasan, (tetramethyl thiuram disulfide), one with spergon (tetrachloro parabenzoquinone). Three plantings, early, medium, and late were made. The mean increase from arasan was 11, 80, and 8%, respectively. Emergence of nine lots was increased and diseased seedlings decreased more by arasan than by spergon. Seed produced at McCullers gave high emergence and few diseased seedlings while seed from Plymouth gave relatively low emergence and many diseased seedlings in both field and greenhouse plantings. Emergence was negatively correlated with seedborne infection. Emergence from both nontreated and treated seed was lower in field than in greenhouse. However, the difference from treated seed was only about one-half that from nontreated seed. Field performance of seed lots can be more accurately predicted from preliminary greenhouse germination tests if treated seed are used and proper appraisal is made of seed infection.

1251. LEHMAN, S. G. 1950. Purple stain of soybean seeds. North Carolina Agr. Expt. Sta. Bull. 369.

A popular article. Purple stain disease has become increasingly prevalent since 1927. The fungus survives in infected seeds and spreads by wind. It is chiefly confined to the seed coat. Seedlings from infected seeds are stunted or killed after emergence. The disease appears on a high proportion of seeds when the crop matures under rainy conditions. Cultivars differ in susceptibility. Dusting plants with a mixture containing 7% Cu gave partial control.

1252. LEHMAN, S. G., H. MURAKISHI, and J. H. GRAHAM. 1951. A leaf spot of soybean caused by *Sclerotium rolfsii.* Plant Dis. Reptr. 35:167–168.

Sclerotium rolfsii is described as a leaf spot for the first time, found at Rocky Mount, N.C. Lesions circular in outline, medium brown to light brown or straw color, with a narrow band of darker necrotic tissue at the border. The narrow border was more conspicuous on smaller than on larger spots. Concentric circular markings were visible on many lesions. Most lesions were 1 cm or less in diameter. Small clumps of white mycelium were visible at center of many lesions, and on many lesions a small, spherical, brown sclerotium replaced the mycelial clump. Lesions were on leaves touching soil and others 25–30 cm above soil.

1253. LEHMAN, S. G. 1952. Survival of the purple seed stain fungus in soybean seeds. Phytopathology 42: 285. (Abstr.)

Purple stain of soybean seeds is caused by the fungus *Cercosporina* (= *Cercospora*) *kikuchii.* Germination tests with infected seeds showed that in some lots the purple stain fungus died in a high percentage of seeds between the first and second planting season after harvest. In other lots the fungus was still alive in many seeds 3 months before the second planting season. The fungus had died in all seeds previous to the third planting season. Infected purple-stained seeds were adjusted to moisture levels of 6.3, 10.8, and 15.3%. Seeds of each moisture level were stored 10 months in closed jars at temperatures of 8, 12, 16, 20, 24, and 28 C. The fungus lost viability more rapidly in seeds of high and medium moisture than in seeds of low moisture. Loss of viability by the fungus in seeds of high and medium moisture was markedly accelerated by storage at 16 to 20 C or above. Only slight loss of viability of the fungus occurred at 8 or 12 C regardless of moisture content of the seeds. At the higher temperature and moisture levels the seeds lost viability less rapidly than the fungus in the seeds.

1254. LEHMAN, S. G. 1953. Race 4 of the soybean downy mildew fungus, *Peronospora manshurica.* Phytopathology 43:460–461.

Race 4 of the fungus is described. This race did not affect cultivars Illini or Richland which are infected by races 1, 2, and 3.

1255. LEHMAN, S. G. 1953. Systemic infection of soybean by *Peronospora manshurica* as affected by temperature. J. Elisha Mitchell Sci. Soc. 69:83. (Abstr.)

Rapidity of germination of oospore-encrusted seed seems to affect the percentage of seedlings that become systemically infected. When these seeds germinate slowly, as in cold (13 C) soil, up to 40% of the seedlings show systemic infection. If the seeds are planted in warm soil (18 C or above), none of the seedlings show systemic infection. Either the oospores on the seed fail to infect the seedling at 18 C, or the seedlings outgrow the fungus. Planting after the soil has reached an average temperature of 18 C appears to offer a means of controlling systemic infection and thus reduce the quantity of early inoculum in the field.

1256. LEHMAN, S. G. 1958. Physiologic races of the downy mildew fungus on soybeans in North Carolina. Phytopathology 48:83–86.

Four new races of the downy mildew fungus (*Peronospora manshurica*) were obtained from collections of infected soybean seed harvested in North Carolina. The new races are designated 3A, 5, 5A, and 6. The reaction of 37 cultivars of soybean to each new race was determined. Ten cultivars, Mukden, Richland, Illini, Roanoke, Acadian, CNS, Ogden, Palmetto, Woods Yellow 1, and S-100, are suggested as a set of differential cultivars for separating all races thus far described in the United States. Race 3A is regarded as a subrace of race 3 previously described by Geeseman from a collection made in Tennessee. It differs from races 4, 5, and 5A by its

ability to incite severe disease on CNS and on Ogden and from race 6 by its inability to infect Mukden and S-100. Races 5 and 5A differ from race 4, previously described from North Carolina, by their ability to incite severe disease on S-100 and light to moderate disease on Illini, Ogden, and Palmetto, cultivars immune from race 4. They differ from race 6 by their inability to infect Mukden and Richland and their ability to cause disease on Acadian.

Race 6 causes severe disease on the cultivars Illini, CNS, and Ogden, which are immune from race 4. The soybean cultivars Arksoy, Chief, Dorman, Dunfield, Otootan, Ralsoy, Rose Non Pop, Virginia Brown, and P.I. 157-463A show no symptoms after inoculation with any of the newly recognized races, whereas Cherokee, Mammoth Yellow, Mamotan, Rokusun, Tar Heel Black, Tokio, Volstate, and Jackson are moderately to highly susceptible to all of them.

1257. LEPIK, E. 1938. [Phytopathological notes 10.] Phytopath. Expt. Sta. Univ. Tartu. Bull. 43, pp. 213–225.

New record of *Phyllosticta sojaecola* on soybean in Estonia.

1258. LEPIK, E. 1939. Estonia: Plant diseases new to the country. Internatl. Bull. Plant Protect. 13:105–106.

Phyllosticta sojaecola is reported on soybean leaves in 1935.

1259. LIHNELL, D. 1939. [Some observations concerning soybean diseases in our country.] Vaxtskyddsnotiser, Vaxtkyddsanst. (Stockholm) 3(4–5):69–73.

An account of symptoms and effects of the following diseases in Sweden: Bacteriosis (*Pseudomonas glycinea*), downy mildew (*Peronospora manshurica*), *Sclerotinia* (= *Whetzelinia*) *sclerotiorum,* and soybean mosaic virus.

1260. LIKHITE, V. N. 1936. Host range of the Gujarat cotton root rot. Proc. Assoc. Econ. Biol. Coimbatore 3: 18–20.

Macrophomina phaseoli (= *M. phaseolina*) infected soybean in field tests in India.

1261. LIN, S. 1966. Studies on physiologic races of soybean rust fungus, *Phakopsora pachyrhizi* Syd. [in Chinese, English summary]. J. Taiwan. Agr. Res. 51:24–28.

Nine isolates obtained by single uredospore isolation from rusted soybean leaves collected at three locations in this island were tested on tentatively selected differential plants, consisting of six soybean cultivars and five leguminous plants. No marked differences in pathogenicity of the isolates of the rust fungus were observed on soybean cultivars. However, the nine isolates could be separated into six pathogenic groups differing mainly in their reactions on three leguminous plants; (1) isolate H-CH_1 infects and forms sori on asparagus bean; (2) isolates H-CH_2, H-NK_5, and M-T infect asparagus bean and kidney bean, but form sori only on kidney bean; (3) isolates H-S and H-P infect asparagus bean and kidney bean but there is no sorus formation on either one; (4) isolate K-P showing no pathogenicity to asparagus bean infects and forms sori on kidney bean; (5) isolate M-64-37 infects neither asparagus bean nor short-podded yam bean; (6) isolate KS-55S showing no pathogenicity to asparagus bean infects short-podded yam bean but there is no sorus formation.

1262. LIN, Y., and L. WU. 1966. Seed-borne diseases of soybean in Taiwan. II. Anthracnose. Plant Prot. Bull. (Taiwan) 8:305–317.

Etiological and morphological studies indicate that the pathogen of soybean anthracnose is included in the two different species *Colletotrichum truncatum* and *Glomerella glycines*. *G. glycines* seemed to be described for the first time in Taiwan. Virulence of the isolates within species *C. truncatum* was varied. Six distinct cultural strains were found by comparing the monospore isolates of the same fungus. Sporulation was highly affected by cultural conditions and growth was greatly inhibited by antimucin, granosan, rioben, ruberon, sankinon, and takeda meru by the paper disk plate method.

1263. LINDSEY, D. W., and E. J. CAIRNS. 1971. Pathogenicity of the lesion nematode, *Pratylenchus brachyurus,* on six soybean cultivars. J. Nematol. 3:220–226.

Pathogenicity tests of *Pratylenchus brachyurus* on selected glasshouse-grown soybean cultivars indicated the nematode reduced seed yield of Hood but not of Custer, Bragg, Dyer, or Pickett. Root weights of all cultivars were reduced. Damage and numbers of nematodes within soybean roots growing at 13, 21, and 29 C were greater at higher temperatures. At 29 C, root pruning was prominent in Hood and Pickett, but limited in Custer and Hill. Root pruning was not observed at 13 C and only Pickett showed pruning at 21 C. Plant height and foliage weight were not affected. *P. brachyurus* had no effect on emergence of Pickett or Bragg soybeans. Nematode counts from roots of Pickett at intervals after inoculation indicated that hatching of second-generation larvae occurred about 15 days after egg-laying. An average of 68% of the initial inoculum penetrated the roots within 5 days. Details of structural damage in penetrated tissues were studied in sectioned roots. In soybean roots infected by *P. brachyurus* and (or) *Rhizoctonia solani,* greater damage occurred with nematode and fungus combined than with either acting alone.

1264. LING, L. 1940. Seedling stem blight of soybean caused by *Glomerella glycines.* Phytopathology 30:345–347.

In China, seedlings frequently are killed by anthracnose fungus soon after emergence. Infection appears on cotyledons as darkened cankers, gradually extending down-

ward to hypocotyl. The stem is rotted and in a short time collapses. The fungus surviving in seeds serves as primary inoculum. Conidia of the fungus are short-lived and susceptible to drying.

1265. LING, L., and J. Y. YANG. 1944. Studies on the biology and pathogenicity of *Colletotrichum indicum.* Ann. Bot. (London) (n.s.) 8:91–104.

Soybean pods were infected by the fungus in inoculation tests.

1266. LING, L., and K. R. LIN. 1944. On the occurrence of *Colletotrichum capsici* in China. Indian. J. Agr. Sci. 14:162–167.

Colletotrichum capsici is essentially similar to *C. truncatum* (= *C. dematium* f. *truncata*) and *Glomerella glycines* in culture characters. *C. capsici* and *C. indicum* virulently infected soybeans.

1267. LING, L. 1948. Host index of the parasitic fungi of Szechwan, China. Plant Dis. Reptr. Suppl. 173:1–38.

Includes a list of the following fungi parasitic to soybean: *Alternaria* sp., *Ascochyta sojae, Cercospora sojina, C. kikuchii, Colletotrichum* sp., *Diaporthe sojae* (= *D. phaseolorum* var. *sojae*), *Fusarium bulbigenum, F. solani, Glomerella glycines, Macrophoma mame, Mycosphaerella sojae, Ophionectria sojae, Peronospora manshurica, Phyllosticta sojaecola, Pleosphaerulina sojaecola, Pythium* sp., *Rhizoctonia solani, Sclerotinia* (= *Whetzelinia*) *sclerotiorum, Sclerotium rolfsii,* and *Phakopsora pachyrhizi.*

1268. LING, L. 1951. Bibliography of soybean diseases. Plant Dis. Reptr. Suppl. 204:109–173.

Contains an annotated list of 503 titles of the papers published from 1882–1950 on soybean diseases.

1269. LINK, G. K. K., and C. G. SHARP. 1927. Correlation of host and serological specifics of *Bacterium campestris, B. flaccumfaciens, B. phaseoli* and *B. phaseoli sojense.* Bot. Gaz. 83:145–160.

Agglutination tests show that the biological specificity displayed by these bacteria in their host relations is associated with serological or immunological specificity.

1270. LISTER, R. M. 1960. Transmission of soil-borne viruses through seed. Virology 10:547–549.

Soybean plants were inoculated with tomato black ring virus, raspberry ring spot virus, and arabis mosaic virus. Tomato black ring virus was transmitted through a high percentage of seeds borne on inoculated plants whereas little or no seed transmission of other viruses occurred.

1271. LISTER, R. M., and A. F. MURANT. 1961. Soilborne viruses: Viruses with nematodes as vectors. Hort. Res. Inst. Scotland Ann. Rpt. 8 (1960/61), p. 56.

In tests made, cherry leaf roll virus was transmitted through 100% of seeds of soybean.

1272. LISTER, R. M., and A. F. MURANT. 1967. Seed transmission of nematode-borne viruses. Ann. Appl. Biol. 59:49–62.

Tomato black ring virus, raspberry ring spot virus, arabis mosaic virus, tomato ring spot virus, and cherry leaf roll virus were seed-transmitted in soybeans.

1273. LITZENBERGER, S. C., and J. A. STEVENSON. 1957. A preliminary list of Nicaraguan plant diseases. Plant Dis. Reptr. Suppl. 243:1–19. [In Spanish, Ceiba 8:19–39 (1959).]

Cited as occurring on soybeans growing on the Pacific side are: *Cercospora canescens, C. kikuchii, Helminthosporium vignicola* (= *Corynespora cassicola*), and *Xanthomonas phaseoli* var. *sojense.*

1274. LITZENBERGER, S. C., M. L. FARR, and H. T. LIP. 1962. A preliminary list of Cambodian plant diseases. 29 pp.

Reports the occurrence on soybeans of: *Cercospora flagellifera* Atk., *Colletotrichum gloeosporioides* Penz. (black spot), *Corynespora cassicola* (Berk. & Curt.) Wei (target spot), *Mycosphaerella cruenta* (Sacc.) Lan., *Myrothecium roridum* Tode ex Fr., *Phakopsora pachyrhizi* Syd., *Vermicularia* sp., *Sclerotium rolfsii* Sacc., and *Xanthomonas phaseoli* (E. F. Smith) Dows.

1275. LIU, K. 1940. Studies on a Fusarium disease of soybean pods. Mem. Coll. Agr. Kyou Imp. Univ. 47:15–29.

Pure cultures of the agent of a destructive pod blight of soybeans interplanted with rice in Japan were compared with similar material of *Gibberella* sp. and *G. fujikuroi* and found to be distinct. Morphologically the fungus is identical with *Fusarium bulbigenum* var. *tracheiphilum.* Under natural conditions in the locality under observation the pathogen is confined to the pods, on which it produces brownish lesions, gradually enlarging to involve almost half or more of the surface. In advanced stages the pods bear flesh- or salmon-colored sporodochia of the fungus. Pods infected when young generally shrivel and dry without forming seeds, whereas on older ones the lesions are limited by a brownish line and permit partial development of seeds which are sometimes attacked by the fungus. In moist chamber and greenhouse inoculation experiments with conidial suspensions the unwounded pods and stems became affected, though the latter remained healthy for a long time. The infection of stems is of some interest in view of occurrence of the fungus on soybean roots and stems in the United States. Conidial germination and germ tube growth tended to decrease under the influence of daylight. Germination took place readily in drops of conidial suspension but after the drops were dried it was very considerably re-

duced in an atmosphere of 100% humidity and did not take place at all at 99%. Optimum temperature for the process appears to lie at about 24 C, within the range 16 to 36 C.

1276. LIU, S. T. 1948. Seed-borne diseases of soybean. Bot. Bull. Acad. Sinica 2:69–80.

Diaporthe phaseolorum var. *sojae* caused serious damage especially when pods were attacked in rainy season. Stems, pods, seeds, and petioles and sometimes leaves were attacked, infection often starting where branches have been injured. The fungus is sometimes accompanied by fruiting bodies of other organisms particularly of *Glomerella glycines,* which are scattered, whereas those of *D. phaseolorum* var. *sojae* are usually in rows. Seed-borne fungi from 420 seeds of Yellow Seed cultivar were comprised of 35% *D. phaseolorum* var. *sojae,* 17% *G. glycines,* 13% *Cercospora kikuchii,* 8% *Fusarium* spp., 7% *Penicillium* spp., 6% *Aspergillus* spp., 3% bacteria, 2% *Choanephora,* 1% *Alternaria atrans,* and less than one percent *Phyllosticta sojaecola. Mycosphaerella sojae,* and *Rhizoctonia solani* less than one percent. A leaf spot caused by *Cercospora viginicola* (= *Corynespora cassicola*) is common and is also isolated from seeds. *G. glycines* is very serious on pods in wet weather near harvest time.

A widely spread and highly destructive pod blight (*Macrophoma mame*) causes serious damage. In frequent rainfalls, particularly August to October, infections are epiphytotic. The affected pods bear water-soaked lesions which rapidly enlarge and turn dull, greenish black. The lesion is usually depressed and in wet weather bears abundant white aerial hyphae which soon cover the pod, turn dark, greenish olive and eventually are transformed into a black crust bearing black, globose dots. On inoculated seeds, infection begins as an irregular, water-soaked, natal brown lesion which rapidly enlarges. The seed coat is cracked and the lesion depressed and wrinkled. The black globose to subglobose, sometimes papillate, ostiolate pycnidia were 131–180 μ in diameter; conidiophore clavate, hyaline, simple continuous 7–14 $\times$ 3–5 μ; conidia nonseptate, hyaline, fusiform to narrowly oblong 15–25 $\times$ 6–8 μ, on host and 12–21 $\times$ 4–8 μ in culture. A *Diplodia,* not corresponding to any species known to the writer, was isolated from seeds. In 1947 a severe outbreak of Diplodia black dot on developing pods was seen. In serious cases it might involve the entire plant. Fungal growth on pod was rapid and pod was soon covered. The black, pyriform or globose, slightly immersed pycnidia 290–392 $\times$ 232–290 μ, brown to olive, oblong, uniseptate spores, slightly constricted at the septum averaged 22–13 μ. Inoculation on leaves, hypocotyls and cotyledons caused tawny or brown, sometimes sunken spots.

1277. LIU, Y. 1963. A preliminary study on the diagnosis of soybean mosaic virus [in Chinese, English summary]. Acta Phytopath. Sinica 6:209–213.

As the concentration of virus in diseased leaves was very low the particles (650–700 $\times$ 13–15 nm) could be identified easily by direct electron microscopy of the nonpurified extract. No difference was observed between absorption curves of nucleic acid preparations from diseased and healthy leaves.

1278. LO, T. C. 1964. Control of seedborne diseases by radioactive irradiation. Bot. Bull. Acad. Sinica 5:1–16.

Gamma-radiation against purple seed stain of soybean (*Cercospora kikuchii*) showed that the pathogen is generally more resistant than host and high dosage could inhibit seed germination. Plants from radiated seeds were reduced in height, had pale-green leaves, and growth and pod production decreased with increased dosage.

1279. LO, T. C. 1966. Transmission of soybean rosette by leafhopper *Neosphrosyne orientalis* Matsumura. Plant diseases in Pacific. Proc. 11th Pacific Sci. Cong., Tokyo, Aug.–Sept. 1966. 15 pp.

The virus of this new disease in Taiwan, characterized by virescent flowers, small leaves, abnormal branches, and decreased yield, is transmitted efficiently by *Neosphrosyne orientalis.* Incubation period in the vectors was 16–21 days following acquisition feed for 24–48 hr. Numerous other plants were susceptible in inoculation tests.

1280. LO, T. C., and Y. H. HAN. 1969. Studies on witch's broom of soybean [in Chinese]. Bot. Bull. Acad. Sci. Taipei (n.s.) 10:10–22.

Witch's broom, a new disease of soybean found in Taiwan, is here described. The most conspicuous symptoms are phyllody of blossoms and development of a great number of small leaves and abnormal branches. In most cases no pods are produced by infected plants, thus soybean yield is decreased. Accumulation of starch has been found to occur in stems as a consequence of infection. Starch content is higher in pith and parenchymatous cells in infected tissues than in noninfected ones. Cross sections of stems and petioles of infected plants show thickening of xylem in the vascular bundles. No inclusion bodies are found in tissues of infected plants. The disease is not transmitted by mechanical means nor by seed. Results of transmission experiments conducted under greenhouse conditions prove that *Neosphrosyne orientalis* is an efficient vector of the witch's broom pathogen. The insect infected test plants in 18–21 days and 16–20 days following acquisition feeding for 24 hr. and 48 hr. respectively. The following plants were found with witch's broom symptoms after inoculation feeding by *N. orientalis*: peanut, cowpea, kidney bean, zinnia, crotalaria, common cosmos, radish, pea, sun hemp, cornflower, red bean, "Fukwei" pea, centro, Rhodesian kudzu, hairy indigo, globe amaranth, broad bean, and snapdragon. Most of the diseased plants developed phyllody, certain leaflike special features, and excessive abnormal branches. Typi-

cal symptoms of witch's broom can also be found on several crop plants naturally infected in the fields.

1281. LOBIK, V. I. 1930. The problem of the diseases of the soybean in the light of observations in 1930 at Essentuki [in Russian]. North Caucasian Plant Prot. Sta., Rostoff-on-Don, Bull. 6–7, p. 285.

Next to the bacterial leaf spots, the economically most important disease of soybeans in North Caucasus in 1930 was a wilt caused by *Fusarium* sp. The affected plants were yellow: usually the whole plant, but sometimes the main stem, died. Downy mildew (*Peronospora manshurica*) was found on soybean cultivars introduced from Asiatic Far East and a species of *Botrytis* was found attacking cultivar Krushulya.

1282. LOCKWOOD, J. L., D. L. YODER, and N. A. SMITH. 1970. *Thielaviopsis basicola* root rot of soybean in Michigan. Plant Dis. Reptr. 54:849–850.

In a survey of soybean root diseases in southern Michigan, *Thielaviopsis basicola* was found causing a root necrosis in several fields. Isolates of this fungus caused severe root and hypocotyl decay in greenhouse pathogenicity tests, but did not kill plants. *Clasterosporium* sp. was also isolated from diseased soybean roots from some fields and was shown to be pathogenic.

1283. LORDELLO, L. G. E. 1951. *Xiphinema campinense,* noua especie (Nematoda Dorylamidae) [in Portuguese, English summary]. Bragantia 11:310–311.

New species from soybean is reported.

1284. LORDELLO, L. G. E. 1955. Nematode attacking soybean in Brazil. Phytopathology 45:465. (Abstr.)

One of the most serious detriments to soybean cultivation in the state of São Paulo, Brazil, is infection by meadow and root-knot nematodes. Of the two, root-knot nematodes are best known to growers. Investigations have been carried out to select resistant cultivars that could be cultivated on a large scale or used in breeding work. The cultivar La. 41-1219, introduced from the United States as one susceptible in Mississippi, was injured by *Meloidogyne incognita* but resistant to a closely related form to be described elsewhere as a new species. The cultivar N 46-2652, introduced as a resistant strain, was injured by the new species of nematode. The cultivar Abura, one of the most widely cultivated, was attacked by the new species and also by an undescribed subspecies of *M. javanica.* The three members of *Meloidogyne* referred to here are the root-knot forms involved in the soybean problem up to the present.

1285. LORDELLO, L. G. E. 1955. Nematodes attacking soybean in Brazil. Plant Dis. Reptr. 39:310–311.

One of the most serious detriments to soybean cultivation in the state of São Paulo, Brazil, is infection by root-knot (*Meloidogyne* spp. and *M. incognita, M. javanica*), and lesion nematodes (*Pratylenchus* spp.).

1286. LORDELLO, L. G. E. 1956. *Meloidogyne inornata* sp.n., a serious pest of soybean in the state of São Paulo, Brazil (Nematoda, Heteroderidae). Riv. Brasil. Biol. 16:65–70.

A new species, *Meloidogyne inornata,* is described from the Campinas region of São Paulo, Brazil. It attacks some soybean cultivars, but cultivar La. 41-1219 is resistant. It closely resembles *M. incognita* but differs in usually having wider eggs (37.5–60 μ as compared with 30–38 μ). Head of the preparasitic larva and of the male has only one wide postlabial annule instead of three, and the excretory pore in the female is further back, between the 17th and 22nd annule, from the head. *M. incognita* also differs in that it does attack La. 41-1219. The perineal pattern of *M. inornata* may be confused with that sometimes found in *M. incognita* and therefore provides an example of a species that cannot be identified by this character alone.

1287. LORDELLO, L. G. E. 1956. [Nematoides que parasitism a soja na regiao de Bauru.] Bragantia 15:55–64.

Three nematodes have been found damaging soybeans in the state of São Paulo, Brazil, namely *Pratylenchus* sp., *Meloidogyne incognita,* and *M. javanica bauruensis* n. subsp. The new subspecies is described and figured. It differs from *M. javanica* in having broader eggs, a slightly longer stylet, and a longer oesophagus in proportion to total length in the larva, a single postlabial annule in the male, and differences in the perineal pattern, which has a high arch with wavy to zigzag striae and the lateral lines less well marked than in *M. javanica.* Male intersexes occurred having female characters in more or less marked degree. Measurements are given of the population of *M. incognita* which differ from those described by Chitwood in having shorter and more slender larvae and shorter spicules. This species attacked only the soybean cultivar La. 41-1219 and *M. javanica bauruensis* only the cultivar Abura.

1288. LORDELLO, L. G. E. 1957. Two new nematodes found associated with soybean roots. Nematologica 2:19–24.

Two new nematode species, *Caracharolaimus formosus* and *Dorylaimus bauruensis,* are described from around roots of soybean heavily disfigured and decaying from root-knot damage. Morphological characters and taxonomy are described.

1289. LORDELLO, L. G. E., and A. P. L. ZAMITH. 1958. Nematodes que prejudicam as culturas de soja e do algodoeiro no Estado de S. Paulo e sua interferencia nos planos de rotacao [in Portuguese, English summary]. Rev. de Agr. 33(3):161–167.

Poorly growing cotton plants had their roots severely attacked by *Pratylenchus steineri.* Soybeans were also damaged by this eelworm and by root-knot nematodes. It is concluded that the rotation soybean-cotton is not suitable because the *Pratylenchus* population will increase on soybeans.

1290. LOUKYANOVITCH, F. K., L. A. LEBEDEVA, V. A. KIZERITSKY, O. I. ERMOLAYEVA, and S. I. OBOLENSKY. 1931. Pests and diseases of agricultural crops in the region of the Turkestan-Siberian Railway [in Russian]. Plant Prot. Leningrad 7:349–360.

In western Siberia where soybeans were tentatively introduced in 1930, all cultivars tested suffered fairly severely from warty spotting caused by *Bacterium sojae* (= *Pseudomonas glycinea*). A large proportion of seedlings were killed by a species of *Fusarium;* the fungus was seedborne. Infected seeds were easily identifiable macroscopically. Where the seed was sorted by hand before planting, seedling mortality was reduced from over 80% to almost nil. Other diseases of soybean observed were caused by *Peronospora manshurica, Sclerotinia libertiana* (= *Whetzelinia sclerotiorum*), and *Ascochyta* sp. on pods.

1291. LU, J. 1970. In vivo trial for the control of soybean mosaic virus with oil [in French]. 62nd annual meeting, 1970, Quebec Soc. Prot. of Plants. Phytoprotection 51:149.

Spraying with an oil emulsion reduced insect transmission of virus by 27% without phytotoxic effects.

1292. LU, Y. C. 1970. Mutation breeding for rust resistance in soybean. Proc. Symp. Improving Plant Protein by Nuclear Techniques, pp. 165–167.

Seeds of three soybean cultivars and three selections were treated with gamma rays, doses of 15, 20, 25, and 30 krad, and second-generation plants were selected for resistance to *Phakopsora pachyrhizi.* Further selections were made in third generation.

1293. LUC, M. 1959. [Nematodes parasites ou soupconnes de parasitisme evers les plantes de Madagascar.] Madagascar Inst. de Rech. Agron. Bull. 3:89–102.

Soybeans were heavily attacked by *Meloidogyne javanica.*

1294. LUEDDERS, V. D., L. F. WILLIAMS, and S. MATSON. 1968. Registration of Custer soybeans. Crop Sci. 8:402.

Custer soybean was developed by incorporating cyst nematode and Phytophthora rot resistance into the cultivar Scott.

1295. LUKEZIC, F. L. 1970. Comparisons between pigments produced by *Cercospora kikuchii* and *C. hayi.* Phytopathology 60:576. (Abstr.)

A purple pigment isolated from cultures of *Cercospora kikuchii* has been shown to cause the disease, purple stain of soybean. *C. hayi,* which causes brown spot on banana fruit, can produce a purple pigment in culture and also induce a purple stain of soybean seed, which suggests that the two pigments are similar if not the same. Purification and preliminary characterization showed that both pigments have identical infrared spectra and melting points, thus proving they are identical. Precursor studies have shown the N source to be important in pigment production by both species. Both species produced the pigment using acetamide and potato broth as N source. *C. kikuchii,* however, used alanine, NH_4Cl, KNO_3, and DL-phenylalanine, while *C. hayi* did not. Diethylamine and KNO_2 were not used by either species. The fact that certain precursors were used by *C. kikuchii* and not by *C. hayi* suggests that different metabolic pathways may be involved in pigment production.

1296. LUSIN, V. 1960. *Cercospora kikuchii* — soybean disease [in Croatian]. Savremena Poljoprivreda 8:601–604.

Symptoms, biology, taxonomy, and morphology are discussed. Yugoslavia.

1297. LUTTRELL, E. S. 1945. Additional hosts of *Diaporthe sojae.* Plant Dis. Reptr. 29:89–90.

Diaporthe sojae (= *D. phaseolorum* var. *sojae*) was observed chiefly on weakened or senescent plants of soybean, snap bean, lima bean, and cowpea, and was almost constantly associated with other fungi, notably *Macrophomina phaseoli* (= *M. phaseolina*). The fungus sporulated on all the crops.

1298. LUTTRELL, E. S. 1947. *Diaporthe phaseolorum* var. *sojae* on crop plants. Phytopathology 37:445–465.

The fungus was proved to be merely a vigorous saprophyte that may fruit quickly upon dead plants. It differs from *Diaporthe phaseolorum* in pathogenicity, in the production of pycnidia in culture, and in the morphology of spores and stromata. It was found on snap bean, cowpea, lima bean, peanut, lespedeza, strophystyles, lupine, pepper, tomato, okra, onion, and garlic.

1299. LYON, H. L. 1911. Some problems in green soiling with additional notes on bean varieties. Hawaii Planters Res. 5:200–210.

Cultivars of legumes including four cultivars of soybean were evaluated for adaptability to Hawaiian conditions in a field infested with a fungus and with *Heterodera radicicola.*

1300. LYSOGOROVA, Z. S., and V. Y. HOTSULENKO. 1965. Virus diseases of soybean and Vigna under irrigated conditions in the South Ukraine [in Russian]. Vikorist Zroshuv. zem Kiev Urozhai, pp. 248–252.

In spring sowing of soybean, incidence of rugose mosaic

was 1–39% and of yellow mosaic 17.5–46%, whereas in postharvest sowings the ranges were 29.7–49% and 33.7–70.7% respectively. Under irrigation, infection increased by 1.4–2.0% compared with nonirrigated crops.

1301. MACHADO, C. C., J. C. GOMES, and P. S. LEHMAN. 1973. Dead patch of soybeans in southern Brazil. 2nd Internatl. Cong. Plant Path. Abstrs.: 1062.

Since 1969 a soybean disease called "Mancha em Reboleira" or dead patch has caused losses reaching 40% in some fields in southern Brazil. Initial symptoms usually are chlorotic lower leaves, darkened veins, and reddish brown cankers on crown and roots, followed by wilting and drying of plants. After death of a few plants, the disease gradually spreads in a circular pattern and at flowering the area with wilted plants expands rapidly, often reaching 20–30 m in diameter. From 1969–1973, roots and stems of green plants at different growth stages were collected at the edges of dead patches for microscopic observations. Results indicated that *Rhizoctonia solani* was the organism most frequently associated with cankers and disintegrating tissue and also was most frequently isolated. However, *Fusarium* spp., *Phomopsis* sp., *Colletotrichum truncatum* (= *C. dematium* f. *truncata*), and *Gliocladium* sp. were considered possibly involved because they were also isolated. To test pathogenicity of these organisms, inoculum was placed in nonsterile soil at two depths at time of planting. Typical field symptoms were obtained only with isolates of *R. solani*. This organism was also pathogenic to soybeans grown in sterile soil and inoculated by placing mycelium under the stem epidermis or at base of plants near the soil line.

1302. MACNEILL, B. H., and H. ZALOSKY. 1957. Histological study of host-parasite relationships between *Septoria glycines* Hemmi and soybean leaves and pods. Canad. J. Bot. 35: 501–505.

Histological studies of the host-parasite relationships between *Septoria glycines* and soybean have revealed that penetration is stomatal without the presence of an appressorium. Subsequent spread of the pathogen is intercellular in the mesophyll tissue and in the parenchyma sheath and phloem of the leaf veins. While the fungus does not show marked action in advance and requires to be in intimate contact with vital cells in order to progress through host tissue, its fruiting bodies are matured only in the holonecrotic region of the lesion. The fungus seems incapable of invading the plesionecrotic zone which borders the holonecrotic region; the role of this zone in limiting the pathogen to a discrete spot has been discussed. Colonization of the pericarp and seed is primarily intercellular, although intracellular hyphae may be found in the sclerenchyma of the subhilum region of the seed. Infection of the seed may occur directly at the point of contact of the seed with the wall, or by systemic invasion via the placenta and funiculus. This study establishes conclusively that *S. glycines* is seedborne in the soybean.

1303. MACNEILL, B. H., and H. HOWARD. 1959. A pea wilt disease new to Ontario. Proc. Canad. Phytopath. Soc. 26: 13.

Soybean is a symptomless carrier of *Fusarium oxysporum* f. *pisi* of race 2.

1304. MACNEILL, B. H., and P. S. JUO. 1964. Seed transmission of tobacco ring spot virus in soybean. Proc. Canad. Phytopath. Soc. 31: 13.

Soybean was systemically infected by tobacco ring spot virus. The transmission of some strains of tobacco ring spot virus by soybean seed through systemic infection of the epicotyl-hypocotyl region of embryo has been demonstrated. Soybean plants inoculated mechanically after the development of trifoliolates did not produce infected seeds.

1305. MAI, W. F., H. W. CRITTENDEN, and W. R. JENKINS. 1960. Distribution of stylet-bearing nematodes in the northeastern United States. New Jersey Agr. Expt. Sta. Bull. 795. 62 pp.

A listing of many stylet-bearing nematodes associated with soybeans in the northeastern United States.

1306. MAISURIAN, N. A., and A. I. MORDASHOV. 1963. Method of separating seed infected by fusariosis from soybean sowing material [in Russian]. Sel. Seed-Gr. Moscow 28: 77–78.

Fusarium-infected seed, when immersed, swells more quickly than healthy seed, as water penetrates more easily through the injured testa. Seeds swollen in 2, 4, and more hours had germination rates of 1, 30, and 80% respectively, and there was a notable difference in health status of the seedlings during postemergence growth. As size of swollen seed increased 1.5–2 times, separation of most of the infected seed is possible with nets.

1307. MAJOR, T. G. 1925. Report on tobacco disease investigations. Rpt. Tob. Div. Dom. Expt. Farms, Canada, 1923, pp. 38–41.

Thielavia (= *Thielaviopsis*) *basicola* can infect soybeans by artificial inoculation.

1308. MAKRAM, M. W., and S. T. SIDKEY. 1969. Alternaria leaf spot disease of soybeans and its control. Agr. Res. Rev. Cairo 47: 130–136.

In Egypt, *Alternaria atrans* was isolated from infected plants. Of eight cultivars tested, A Bienville, B Bienville, B Hampton, and Jew 45 were partly resistant. Mancozeb, maneb, and zineb, in that order, gave the best control. Yield was significantly increased on treatment.

1309. MALEK, R. B., D. P. TAYLOR, and D. I. EDWARDS. 1970. The barley root-knot nematode. Illinois Res. 12(2): 3–4.

A popular article. Although *Meloidogyne naasi* has not been found attacking field soybeans in Illinois, greenhouse studies have shown soybeans as a host. Recommendations for control are presented.

1310. MALEK, R. B., and D. I. EDWARDS. 1973. Battling the soybean cyst nematode. Illinois Res. 15:12–13.

A popular article. A general discussion of the soybean-cyst nematode (*Heterodera glycines*) is given with control suggestions. Blending susceptible and resistant soybean seed is offered as a control possibility.

1311. MALLOCH, W. S. 1923. The problem of breeding nematode resistant plants. Phytopathology 13:436–450.

Soybean was found to be infected by *Heterodera radicicola.*

1312. MALO, S. E. 1964. A review of plant breeding for nematode resistance. Proc. Soil and Crop Sci. Soc. Florida 24:354–365.

A brief discussion concerning the initial work in development of soybean cultivars resistant to *Heterodera glycines.*

1313. MANKAU, G. R., and M. B. LINFORD. 1956. Soybean varieties tested as hosts of the clover-cyst nematode. Plant Dis. Reptr. 40:39–42.

Twenty-seven cultivars of soybean were tested in pot culture for susceptibility to an Illinois population of the clover-cyst nematode, *Heterodera schachtii* var. *trifolii.* Larvae were found to enter the roots of all cultivars freely. Small numbers of mature females and cysts with eggs were found in only two cultivars, Dunfield and Earlyana, and a few stunted, immature females were observed on the roots of six others, but no enlarged nematodes were observed on the remaining 19 cultivars.

1314. MANKIN, C. J., and L. S. WOOD. 1971. Soybean seedling blight, *Fusarium, Rhizoctonia,* and *Pythium.* Amer. Phytopath. Soc. Fungicide and Nematicide Tests, Results of 1970. 26:144.

Two systemic and one standard fungicides were used to treat Amsoy soybean seed at one or more rates. The treated seed was planted in the field in randomized two-row plots 12 ft. long, replicated three times. Stand counts were made when emergence appeared to be complete. Benlate at the higher rates had a toxic effect on the beans; some plants died after emergence counts had been made.

1315. MANNINGER, E., and M. ANATAL. 1964. A study of the disinfection of seeds [in German, English summary]. Zentralb. für Bakteriol. Abt. II, 118:379–382.

A 1% solution of thimerosale completely disinfected soybean seed without affecting germination. A 0.5% solution was also effective. Fungi involved are not named.

1316. MANNS, T. F. 1913. A bacterial disease of the sweet pea and clovers. Phytopathology 3:74–75.

Bacillus lathyri infected soybean in inoculation tests.

1317. MANNS, T. F. 1915. Some new bacterial diseases of legumes and the relationship of organisms causing the same. Delaware Agr. Expt. Sta. Bull. 108, pp. 1–44.

1318. MANNS, T. F., and J. F. ADAMS. 1924. Department of plant pathology and soil bacteriology. Delaware Agr. Expt. Sta. Ann. Rpt. 1923, pp. 25–48.

A mosaic disease of soybeans involving mottling and atrophy of leaves appeared commonly in Delaware.

1319. MANNS, T. F., and J. F. ADAMS. 1925. Department of plant pathology. Delaware Agr. Expt. Sta. Bull. 141, pp. 24–30.

Records the following diseases on soybeans: Leaf spot caused probably by *Septoria glycines,* downy mildew (*Peronospora manshurica*), and bacterial pustule caused by *Bacillus* (= *Xanthomonas*) *phaseoli* var. *sojense.*

1320. MANNS, T. F., and J. F. ADAMS. 1929. Department of plant pathology. Delaware Agr. Expt. Sta. Bull. 162, pp. 53–57.

Septoria glycines, Colletotrichum glycines (= *C. dematium* f. *truncata*), and *Bacterium* (= *Xanthomonas*) *phaseoli sojense* occurred in soybean seed disinfection plots.

1321. MANNS, T. F., and J. F. ADAMS. 1934. Department of plant pathology. Delaware Agr. Expt. Sta. Bull. 188, pp. 36–46.

Records occurrence of bacterial pustule and frog-eye leaf spot in Delaware. Seeds infested with *Bacterium sojense* (= *Xanthomonas phaseoli* var. *sojense*) may inhibit seed germination.

1321a. MARCHETTI, M. A. 1974. Dispersal of uredospores of *Phakopsora pachyrhizi* by simulated rain. Proc. Amer. Phytopath. Soc. 1:153. (Abstr.)

Soybean rust is caused by *Phakopsora pachyrhizi* Syd., a fungus not yet reported from the Western Hemisphere. It is one of the major diseases of soybeans in the Far East and if introduced might threaten soybean production in North America. Greenhouse studies are being conducted within containment facilities to elucidate the epidemiology of this disease. Secondary spread in a greenhouse with an average laminar airflow of 40 m/min. was negligible, although conditions favorable for sporulation and infection were present. The role of rain as a dispersing agent in the absence of discernible air movement was investigated. Rust-free potted Wayne soybean plants were misted with H_2O to run-off and arranged at

various distances from a group of 9 pots of heavily rusted soybeans. One-eighth-inch of rain was splashed onto the rusted soybeans, as droplets from a perforated can held 2.5 m above the plants. Rust pustules appeared subsequently on plants that had been placed 2.75 m from rain-splashed rusted plants. Pustule counts on plants located 30 cm to 210 cm at 30-cm intervals from the source of inoculum indicated a decrease in inoculum density by one-half for every 20 cm increase in distance from the source.

1322. MARCHIONATTO, J. B. 1947. [Parasitic fungi of plants, new or little known in Argentina.] Min. Agr. Buenos Aires, Pub. Misc. Ser. A., pp. iii, 37.

Sclerotinia (= *Whetzelinia*) *sclerotiorum* was isolated from soybeans.

1323. MARCHIONATTO, J. B. 1949. Exotic fungi [in Spanish]. Lilloa 21:135–153.

Rhizoctonia bataticola (= *Macrophomina phaseolina*) was identified on a root from Porto Alegre, Brazil, 1941. Numerous blackish sclerotia in the pith characterizes this fungus.

1324. MARKLEY, K. S. 1951. Soybeans and soybean products. 2 vols. Diseases, pp. 50–54. Interscience, New York, N.Y.

A brief review of soybean diseases.

1325. MARKS, G. C., and J. E. MITCHELL. 1970. Detection, isolation, and pathogenicity of *Phytophthora megasperma* from soils and estimation of inoculum levels. Phytopathology 60:1687–1690.

Phytophthora megasperma was isolated from soils and identified, using 3-day-old alfalfa seedlings floated over flooded soil as bait. The seedlings were injured prior to use by pinching the hypocotyl with fine tweezers. The fungus sporulated vigorously on the seedlings 72–96 hr. after immersion and could be identified directly. Soil isolates were virulent to vernal alfalfa as an isolate from a tap root lesion. They caused rapid and extensive rot in the nonthickened roots and lesions on the tap roots, followed by foliar discoloration, wilting, reduced top growth, small leaves, and frequently plant death. The baiting method was used to study distribution of the pathogen in alfalfa soils. Highest population density of the fungus occurred in a poorly drained, heavy silt-loam with a history of severe alfalfa rot. The fungus could not be detected on contiguous well-drained hill slopes and crests.

1326. MARTIN, G. C. 1955. Plant and soil nematodes of the Federation of Rhodesia and Nyasaland. Preliminary investigations. Nematodes catalogued under hosts or associated plants. Rhodesia Agr. J. 52:346–361.

Cultivar S.E.S. No. 6 was heavily infected with *Meloidogyne javanica.*

1327. MARTIN, G. C. 1961. Frequency of occurrence of genera of plant-parasitic nematodes in soil samples from the Federation of Rhodesia and Nyasaland. Rhodesia Agr. J. 58:322–323.

Aphelenchoides sp., *Ditylenchus* sp., and *Meloidogyne javanica* were reported from roots of soybeans. Root-knot nematodes caused severe damage.

1328. MARTIN, J. N. 1942. The effect of freezing temperatures in December 1941 and January 1942 in Story, Boone, and Polk counties on the viability of soybeans of the 1941 harvest. Proc. Iowa Acad. Sci. 49: 215–216.

Most of the yellow soybeans in the farmers' bins in central Iowa endured the fall and January cold without considerable impairment of viability, whereas beans remaining in the field were damaged beyond any use for seed.

1329. MARTIN, J. P. 1944. Pathology. Hawaii Sugar Expt. Sta. Rpt. 1942–1943, pp. 19–28.

Pseudomonas glycines (= *P. glycinea*) on soybean was under investigation.

1330. MARTIN, W. J., and W. BIRCHFIELD. 1955. Notes on plant-parasitic nematodes in Louisiana. Plant Dis. Reptr. 39:3–4.

Dorylaimus sp., *Helicotylenchus* sp., *Hoplolaimus coronatus,* and *Tylenchorhynchus* sp., were found in soil collected around soybean plants.

1331. MARTIN, W. J. 1956. Propagation and pathogenicity of *Trichodorus* sp. on cotton and other crops in Louisiana. Phytopathology 46:20. (Abstr.)

Studies were made on propagation and pathogenicity of an undescribed species of *Trichodorus* on cotton, corn, sweet potatoes, and soybeans. The nematode was found abundantly in certain Red River-deposited soils planted mainly with cotton. Comparatively pure populations of *Trichodorus* were established from hand-picked specimens by placing them on corn growing in sterilized soil. Subsequent controlled infestations were made with these populations. In experiments with cotton the nematode propagated abundantly on Coker 100 WR without causing measurable differences in stand, height, or green weight. In one of two tests with cotton cultivar Deltapine 15, green weight appeared to be reduced as a result of nematode infestation. In tests with corn (Golden Cross Bantam), sweet potatoes (Porto Rico), and soybeans (Pelican), the *Trichodorus* propagated abundantly on corn and soybeans leaving little or no evidence of injury on roots of these plants. There was comparatively little increase of the nematode on sweet potatoes, and no root injury was noted on that crop.

1332. MARTIN, W. J., and W. BIRCHFIELD. 1972.

Endogone sp. in roots of sweet potatoes and soybean in Louisiana. Plant Dis. Reptr. 56:58.

First report of occurrence of *Endogone* in soybean roots in Louisiana.

1333. MARTINSON, C. A. 1963. Inoculum potential relationships of *Rhizoctonia solani* measured with soil microbiological sampling tubes. Phytopathology 53:634–638.

Soil microbiological sampling tubes (SMST) were used to measure the inoculum potential of *Rhizoctonia solani* in nonsterile soil. Pathogenicity of this primitive parasite was closely correlated with competitive saprophytic ability as measured by invasion of SMST. When inoculum density, temperature, or concentration of pentachloronitrobenzene (PCNB) in soil (all factors affecting inoculum potential) was varied, the frequency for isolation of *R. solani* with SMST correlated closely ($r = 0.96$) with the preemergence damping-off of radishes. As the inoculum density of *R. solani* was increased geometrically, the frequency of isolation of the fungus with SMST and the relative damping-off of radishes increased nearly linearly at 25 C. At high inoculum densities of *R. solani,* more PCNB was required to control the disease than at low inoculum densities. Evidence suggested that PCNB has a greater effect on parasitic activity of *R. solani* than on its saprophytic activity.

1334. MARTYN, E. B. 1933. Preliminary list of diseases of economic plants in British Guiana. Kew Roy. Gard., Kew Bull. Misc. Inf. 1933, pp. 107–110.

Records the occurrence of *Phomopsis sojae.*

1335. MARTYN, E. B. 1942. Diseases of plants in Jamaica. Jamaica Dept. Sci. and Agr. Bull. (n.s.) 32. 34 pp.

The cultivar Palmetto is less susceptible to mosaic than the cultivar Trinidad. If the attack is not severe it can be controlled by roguing. *Colletotrichum glycines* (= *C. dematium* f. *truncata*) only becomes serious if wet weather prevails when the crop is ripening. In this case a large percentage of the pods become moldy and fail to develop beans. The disease is seedborne.

1336. MARTYN, E. B. 1944. Plant pathological division. Dept. Agr. Jamaica Rpt. 1942–43, p. 16.

Glomerella glycines caused damage to soybean pods ripening in wet weather.

1337. MASSALONGO, C. 1900. [De nonnullis speciebus novis micromycetum agri veronensis.] Atti R. Inst. Veneto Sci. Lett. ed. Arti. 59:683–690.

Includes a description of *Phyllosticta sojaecola* n.sp.

1338. MATHENY, W. H. 1960. The soybean-cyst nematode; a new Virginia pest. Virginia J. Sci. 11:161–162.

The cyst nematode occurs on 3,000 acres and 53 farms are infested. Current program objectives are to contain the nematode, discourage planting of host crops, and keep trade channels open through certification. Crop rotation controls the pest. Illsoy and Peking are resistant cultivars.

1339. MATHUR, R. S. 1954. Diseases of pulse crops in Uttar Pradesh (India). Agr. and Anim. Husb. 5:24–28.

Most soybean crops of Uttar Pradesh are grown at altitudes of 4,000–7,000 ft. Root rot, due to *Rhizoctonia* and *Fusarium,* causes plants to die prematurely in August and is responsible for heavy losses in some years. The disease also occurs in the plains. The upper portion of the plant droops and turns brown. Roots show a brown-black discoloration at ground level, and black streaks are formed in some cases on the woody portion of the stem. Tiny black sclerotia appear abundantly on the discolored portions of both root and stem. *Cercospora daizu* (= *C. sojina*) is common, particularly on late-maturing cultivars, and in severe cases causes crop losses.

1340. MATSON, A. L., and L. F. WILLIAMS. 1965. Evidence of a fourth gene for resistance to the soybean-cyst nematode. Crop Sci. 5:477.

Results suggest that, in addition to the three recessive genes already reported, a dominant allele closely linked with the I locus for seed coat color is also necessary for resistance to the soybean-cyst nematode. A recombination value of .35% is indicated. In line with the symbols already proposed by Caldwell et al., Rhg_4 rhg_4 are proposed for the resistant and susceptible alleles, respectively, of this fourth locus involved in inheritance of resistance.

1341. MATSUMOTO, S., and H. SAWAHATA. 1966. Effects of attacks by the root-knot nematode on the yield of soybean. Kyushu Agr. Res. 28:82–83.

This report presents the results of soil fumigation experiments conducted in 1964 in soybean fields where population density of root-knot nematode was high.

1342. MATSUMOTO, T., and R. TOMOYASU. 1925. Studies on purple speck of soybean seed. Ann. Phytopath. Soc. Japan 1:1–14.

Purple speck or Shinan disease is caused by fungus described as *Cercosporina* (= *Cercospora*) *kikuchii.* Morphology of the fungus is described and illustrated. It attacks leaves, stem, and pods to some extent and primarily causes damage to seed. The water extract of the mycelium is purple; the pigment becomes red with acid and pale greenish with alkali. Alcoholic extract is bright red. Early cultivars are more susceptible than late-maturing cultivars. Symptoms of the disease are described.

1343. MATSUMOTO, T. 1928. Observations on spore formation in the fungus *Cercosporina kikuchii* [in German]. Ann. Phytopath. Soc. Japan 2:65–69.

Diseased soybean seeds kept in damp petri dishes supported profuse sporulation of *Cercosporina* (= *Cercospora*) *kikuchii* at 15–20 C. Conidia of the fungus were also observed on the inner surface of infected pods collected during harvest, as well as on infected cotyledons, either attached or shed. True chlamydospores, quite distinct from the hyphal cells, were formed on diseased pods at 25 C. Chlamydospores are spherical, 5–12 μ in diameter, and with an orange-yellow membrane 0.85–1.30 μ thick.

1344. MATSUMOTO, T., W. YAMAMOTO, and S. HIRANE. 1932. Physiology and parasitology of the fungi generally referred to as *Hypochnus sasakii* Shirai. I. Differential media. Soc. Trop. Agr. (Taiwan) J. 4: 370–388.

Nineteen strains are compared; there is a key based on growth in potato-dextrose agar. The soybean strain, collected in Formosa, attacked leaves, petioles, and stems.

1345. MATSUO, T., Y. SAKURAI, and H. KURATA. 1958. On wilt of soybean found in Japan and the causal *Fusaria* [in Japanese, English summary]. Shinshu Univ. (Japan) Fac. Text. and Seric., Res. Rpt. 8, pp. 6–13.

Fusarium blight or wilt was found for the first time in various districts of Japan. Morphological investigations and inoculation tests showed the causal fungi to be *Fusarium oxysporum* f. *tracheiphilum* and *F. moniliforme*. The latter could not be distinguished from the causal fungus of the Bakanae disease of rice. Seven Japanese geographic strains of *Fusarium* are discussed in tables.

1346. MATSUO, T., Y. SAKURAI, and H. KURATA. 1959. The form names of *Fusarium oxysporum* and *F. moniliforme* causing soybean wilt [in Japanese]. Ann. Phytopath. Soc. Japan 24:26. (Abstr.)

Fusarium oxysporum f. *tracheiphilum* causes wilt of soybean. *F. moniliforme* (*Gibberella fujikuroi*) was also isolated from wilted plants.

1347. MATVEEVE, E. V., and N. A. OSTROGSKAYA. 1968. [Serological method for identifying bacteriosis of soybean.] Bakter. Bolez. Rast. i Metod. Bor'. s nimi Kiev, pp. 298–301.

Serological tests on different soybean cultivars showed that *Xanthomonas phaseoli* var. *sojense* and *Pseudomonas glycinea* most frequently attack together. Mixed infections were detected on leaves and stems. The serological method of diagnosis was more suitable for late stages of the disease.

1348. MC ALISTER, D. F., and D. W. CHAMBERLAIN. 1951. Water flow through soybean stems infected with brown stem rot. Plant Dis. Reptr. 35:318–319.

In vitro test showed an inverse relationship between the extent of vascular browning of stem and rate of water flow through stem sections.

1349. MC CALLUM, D. K., and O. J. DICKERSON. 1972. Bean (pinto) root lesion nematodes (*Pratylenchus* spp.), soybean (Wayne) root lesion nematode (*Pratylenchus hexincisus*). Amer. Phytopath. Soc. Fungicide and Nematicide Tests, Results of 1971. 27:159.

The effect of nematicides against root-lesion nematodes was evaluated in a greenhouse test in fall 1970. The inoculum consisted of field soil infested with 25 *Pratylenchus hexincisus* per 100 ml. Air temperature averaged 32 C. Indicated amounts of dupont 1410 L were atomized onto 0.25 lb. seeds at 5 psi as the seeds were slowly rotated in a glass container. Fourteen days after the seeds were planted, dupont 1410 L in tap water was sprayed onto foliage (at 30 psi until run-off), taking care that no material reached the soil. Granular formulations were mixed with the soil, and the amount applied was based on 2,000,000 lb. soil per 6 acre-inches. Nematodes were extracted from roots in a constant mist chamber for 7 days. *Pratylenchus* spp. were reduced significantly by all treatments. However, phytotoxicity was observed. Dupont 1410 L seed treatment resulted in poor germination, crinkled and yellowish leaves, and some stunting; severity was proportional to rate, but phytotoxic effects had diminished by 28 days after seeding and were not detectable at 49 days. On soybeans, damage to the terminal bud was severe and permanent, resulting in multiple branching and a broomlike growth. Mocap 10G caused some stunting and yellowing of pinto beans.

1350. MC CALLUM, D. K., and O. J. DICKERSON. 1972. Soybean root lesion nematode (*Pratylenchus hexincisus*). Amer. Phytopath. Soc. Fungicide and Nematicide Tests, Results of 1971. 27:172.

In a field test at Manhattan, Kan., in summer 1970, the effect of different types of nematicides against *Pratylenchus hexincisus* was evaluated. Sandy-silt loam soil was infested with an average of 25 nematodes per 100 ml. Dowfume MC-33 was applied May 6 under polyethylene for 3 days. On May 5, DD was injected 12 in. deep on 12-in. centers (6 in. on either side of the row). On May 18, granular materials were applied in a 12-in. band over each row and rototilled 3 in. deep. On May 25 or June 10, foliar sprays were applied until run-off, using a hand sprayer at 40 psi. The plots were seeded May 18 with Wayne soybeans. There was an excess of moisture and the temperature was relatively low through June, but by July 8 soil was too dry to obtain representative root samples. The plots were irrigated July 15 and 27. Soybean yields in all plots were relatively poor and plants in dowfume MC-33 plots were stunted the first few weeks of the experiment, and were a darker green most of the season. We concluded that soybeans were not a good host for *P. hexincisus* and, based on our experience

with other species of *Pratylenchus,* we assumed that nematode population in the experiment did not increase enough to cause significant soybean yield losses. Only three of the seven sampling dates are reported. The pattern of control suggests that treatments other than fumigants were relatively ineffective against *P. hexincisus* until about 60 days (July 17) after application. By August 29 their effect had diminished.

1351. MC DONALD, J. 1930. Annual report of the mycologist for 1929. Dept. of Agr. Kenya, Ann. Rpt. (1929), pp. 469–479.

Synchytrium dolichi is reported on leaves of *Glycine javanica,* a new record in Kenya.

1352. MC INTOSH, A. E. S. 1951. Annual report of the Dept. of Agr., Malaya, for the year 1949. 87 pp.

Myrothecium sp. caused leaf spots on soybean.

1353. MC KENZIE, T. R., and T. D. WYLLIE. 1971. The effect of temperature and lesion size on the sporulation of *Peronospora manshurica.* Phytopath. Z. 71:321–326.

Small lesions produced significantly fewer conidia of *Peronospora manshurica* at 10, 15, and 30 C than did larger lesions. No conidia were produced at temperatures below 10 C and at 30 C or above. Systemically infected plants were found to lack vigor and did not compare well under held conditions. The percentage of oospore-encrusted seed varied inversely with seed size within a given cultivar, and appeared to be correlated with severity of foliar infection under field conditions. Oospores were found in pith tissue of roots, stems, and petiole, and in endocarpic tissue of the seed pod.

1354. MC KIE, J. W., and K. L. ANDERSON. 1967. The soybean book. State College, Miss. 196 pp.

The authors discuss nematodes of soybeans with most emphasis on the soybean-cyst and root-knot nematodes.

1355. MC LAUGHLIN, J. H. 1942. Notes on diseases of soybean and other legumes in Oklahoma. Plant Dis. Reptr. 26:356–359.

Among soybean cultivars observed, only Chief, Arksoy 152, C-146, Ogden, Habaro, and Sciota remained relatively unaffected by bacterial pustule caused by *Phytomonas phaseoli* var. *sojense* (= *Xanthomonas phaseoli* var. *sojense*).

1356. MC LAUGHLIN, J. H. 1946. Vegetable seed treatment for Oklahoma. Oklahoma Agr. Expt. Sta. Bull. 293.

Damping-off of soybean was caused by *Pythium debaryanum* and *Rhizoctonia solani.* Significant increase of stand was obtained by treating seeds with spergon or arasan.

1357. MC LEAN, D. M. 1960. Diseases caused by tobacco ringspot virus in the Lower Rio Grande Valley of Texas. Plant Dis. Reptr. 44:738–741.

Soybean bud blight observed in the Lower Rio Grande Valley is a yellow strain of tobacco ring spot virus.

1358. MC LEAN, D. M. 1962. Common weed hosts of tobacco ringspot virus in the Lower Rio Grande Valley of Texas. Plant Dis. Reptr. 46:5–7.

Lists the 19 hosts of the virus with description of local and systemic symptoms.

1359. MC NEW, G. L. 1948. Study of soybean diseases and their control. Iowa Agr. Expt. Sta. Rpt. on Agr. Res. for the year ending June 30, 1948, pp. 188–189.

Five cultivars of soybean tested were equally susceptible to *Colletotrichum.* Variation in virulence was noted. Diaporthe canker fungus produced beta spores on steamed stems. Homothallic strain was more virulent than heterothallic. Arasan seed treatment partially controlled hypocotyl infection by *Pythium. Alternaria* sp. caused irregular to circular spots with gray centers on pods. *Cercosporina* was isolated from purple-stained seeds.

1360. MC RAE, W. 1933. Report of the imperial mycologist. Imp. Inst. Agr. Res. Pusa Sci. Rpt. 1931–1932, pp. 122–140.

Cercospora dolichi infected soybeans in inoculation tests.

1361. MEEHAN, F., and H. C. MURPHY. 1946. A new Helminthosporium blight of oats. Science 104:413–414.

Helminthosporium victoriae occurred as a saprophyte or weak parasite on soybeans.

1362. MEHROTRA, R. S. 1972. Behavior of zoospores of *Phytophthora megasperma* var. *sojae* and *P. drechsleri* in soil. Canad. J. Bot. 50:2125–2130.

Experiments with modified soil perfusion apparatus indicate the potential capacity of zoospores and cysts of *Phytophthora drechsleri* and *P. megasperma* var. *sojae* as inoculum units in soil. Results indicate that, although zoospores/cysts do not retain infectivity for months, those of *P. drechsleri* do not lose it rapidly. Experiments to determine period of motility of zoospores have shown that some zoospores of *P. drechsleri* and *P. megasperma* var. *sojae* remained motile up to 30 and 24 hr., respectively. Saprophytic behavior of the two species of *Phytophthora* has been studied with a fluorescence microscope and using a fluorescent dye. Cysts of *P. drechsleri* and *P. megasperma* var. *sojae* germinate to a moderate degree in natural nonamended soil. Germination ranged from 30–50% in the case of *P. drechsleri* and 15–25% in *P. megasperma* var. *sojae.* Amending soil with 0.4% glucose, 0.4% asparagine increased the percentage germination of cysts in natural soil. Germ tubes of a small percentage of cysts in the two species terminate in miniature sporangia-like structures.

1363. MEHTA, P. R., D. N. GARG, and S. C. MATHUR. 1950. Important diseases of food crops, their distribution in India and Uttar Pradesh. Uttar Pradesh (India) Dept. Agr. Tech. Bull. 2. 13 pp.

Cercospora daizu (= *C. sojina*) causes a leaf spot that first appears during November and December throughout Uttar Pradesh and also occurs throughout the rest of India. Damage is slight.

1364. MEJIA, A. S. 1954. Sclerotium wilt of supa (*Sindora supa* Merr.). Philipp. J. For. 9:119–132.

A *Sclerotium rolfsii* strain from supa proved to be pathogenic on soybean seedlings.

1365. MELHUS, I. E. 1942. Soybean diseases in Iowa in 1942. Plant Dis. Reptr. 26:431–432.

Peronospora manshurica occurred for the first time. It was severe and spread rapidly. In late-planted crop, 15–50% of younger leaves became chlorotic. Early-planted crop showed little or no disease. Oospores formed on leaves. *Diaporthe sojae* (= *D. phaseolorum* var. *sojae*) and *Colletotrichum glycines* (= *C. dematium* f. *truncata*) occurred on branches of weak plants. Nonbranching types were free of disease. A new disease, bud blight (?), was severe. Infected plants were stunted at apical region; tip of the stem was curled and brown. Upper leaves showed small necrotic lesions. The pulvinus of most leaves showed a dark-brown, water-soaked appearance. Little if any pod set occurred on severely infected plants.

1366. MELHUS, I. E., J. N. MARTIN, and H. C. MURPHY. 1944. The influence of pythiaceous and other fungi on seedling stands of legumes and other crops. Iowa Agr. Expt. Sta. Rpt. on Agr. Res. for the year ending June 30, 1944. Part 1, p. 157.

Seed treatment of soybean increased the stands with some materials, but not the yield. *Pythium debaryanum, Rhizoctonia* sp., and *Fusarium* sp. were the organisms most frequently obtained from roots. *Colletotrichum glycines* (= *C. dematium* f. *truncata*), *Diaporthe sojae* (= *D. phaseolorum* var. *sojae*), *Pythium* spp. and a soft-rot bacterium were isolated from rotting seeds.

1367. MESSIEHA, M. 1969. Transmission of tobacco ring spot virus by thrips. Phytopathology 59:943–945.

Tobacco ring spot virus was transmitted by nymphs, but not adults, of *Thrips tabaci* from soybean to soybean. Single *T. tabaci* transmitted the virus in only two out of seven experiments with rates of transmission of 7% and 10%. Normally, groups of 10 thrips were used and in such cases transmission up to 26% occurred. Such groups retained the virus for 14 days. Neither *Frankliniella tritici* nor *Sericothrips variabilis* transmitted the virus.

1368. MEW, T. W., and B. W. KENNEDY. 1971. Growth of *Pseudomonas glycinea* on the surface of soybean leaves. Phytopathology 61:715–716.

Each of three pathogenic races of *Pseudomonas glycinea* were sprayed on leaves of three soybean cultivars in the greenhouse and assays were made of bacterial populations on symptomless leaves at intervals up to 240 hr. On susceptible leaves, bacteria increased by about 1,000-fold within 1–2 weeks. Populations were unchanged or declined on leaf surfaces of resistant cultivars. On leaf surfaces of plants intermediate in susceptibility, population increased during the first week but declined during the second week.

1369. MEW, T. W., and B. W. KENNEDY. 1971. Epiphytic pseudomonads on soybean in the field. Phytopathology 61:903. (Abstr.)

A modified Kado's medium, selective for *Pseudomonas,* was used to detect populations of bacteria on leaves of three field-grown cultivars of soybean. By use of UV irradiation and leaf prints, we were able to demonstrate that the pseudomonads were in fact epiphytes, and that more saprophytic pseudomonads were on leaves early in the season than late. In the greenhouse, *Phaseolus vulgaris* was readily infected with isolates of epiphytic pseudomonads pathogenic to soybeans and showed more or less typical water-soaked lesions, but there were no symptoms of systemic infection. As indicated by five major characters of *Pseudomonas,* it was evident that the pathogenic epiphytes were among the Group I pseudomonads. It is concluded that epiphytic pseudomonads pathogenic to soybeans compose a unique group, but vary with season and genotype of the host.

1369a. MEYER, W. A., P. N. THAPLIYAL, J. A. FRANK, and J. B. SINCLAIR. 1970. Phytoalexin production in soybean roots. Phytopathology 60:1304. (Abstr.)

Abstract of entry 1370.

1370. MEYER, W. A., P. N. THAPLIYAL, J. A. FRANK, and J. B. SINCLAIR. 1971. Detection of phytoalexin in soybean roots. Phytopathology 61:584–585.

Phytoalexin production was demonstrated in fibrous root of soybean. Amsoy, Harosoy, and Harosoy-63 seedlings were transplanted at 2, 6, and 12 days following germination in sterile, distilled water without or with zoospores of *Phytophthora megasperma* var. *sojae*. Analyses of water suspensions at 3 and 7 days following inoculation confirmed the presence of phytoalexin only in suspensions containing zoospores.

1371. MEYER, W. A., J. B. SINCLAIR, and M. N. KHARE. 1972. Quantitative isolation of *Macrophomina phaseoli* (*Rhizoctonia bataticola*) from soils using a selective medium. Phytopathology 62:1108. (Abstr.)

An abstract of entry 1373.

1372. MEYER, W. A., and J. B. SINCLAIR. 1972. Root reduction and stem lesion development on soybeans by *Phytophthora megasperma* var. *sojae*. Phytopathology 62:1414–1416.

Phytophthora megasperma var. *sojae* (*Pms*) reduced the root system of soybean in the presence or absence of stem lesions. *Pms*-susceptible cultivars grown in *Pms*-infested soil in the greenhouse and field had no stem lesions, but plant heights and yields were significantly less than those of similarly treated *Pms*-resistant cultivars. In the greenhouse, *Pms* reduced dry weights of roots but not plant heights of 10-day-old resistant plants. Lesions developed on stems of *Pms*-susceptible plants in the greenhouse when inoculum was placed adjacent to plants at 1 or 4 cm below the soil line, but not at 9 cm. Root and shoot dry weights increased with depth of inoculum placement.

1373. MEYER, W. A., J. B. SINCLAIR, and M. N. KHARE. 1973. Biology of *Macrophomina phaseoli* in soil studied with selective media. Phytopathology 63:613–620.

Two selective media using rice agar as the basal medium were developed for isolation and enumeration of *Macrophomina phaseoli* (= *M. phaseolina*) from soil and soybean plant debris. The first, designated as CC, was developed in India and contained chloroneb, ceresan wet, streptomycin sulfate, and potassium penicillin. The second, designated as CMR, was developed at the University of Illinois and contained the same ingredients except that $HgCl_2$ was substituted for ceresan wet and rose bengal was added. Recovery of *M. phaseoli* from artificially infested soil was nearly 100% with either medium. Assays with CC showed that *M. phaseoli* persists in soil under diverse environmental conditions and that populations of the fungus in soil increased with increased years of continuous soybean cropping. Populations of *M. phaseoli* in soil from Illinois soybean and corn fields, determined with CMR, were higher than those determined using the sclerotial-flotation method. In the absence of a suitable host, *M. phaseoli* populations increased and mycelial inoculum persisted in soil up to 7 days. The test fungus was capable of invading dead stem tissues in soil containing antagonistic microorganisms. The evidence does not support the strict classification of *M. phaseoli* as a root-inhabiting fungus.

1374. MEYER, W. A., J. B. SINCLAIR, and M. N. KHARE. 1974. Factors affecting charcoal rot of soybean seedlings. Phytopathology 64:845–849.

During the rainy season in India, soil in field plots was infested with either mycelium or sclerotia of *Macrophomina phaseolina,* or mixed with soybean stubble containing *M. phaseolina*. Emergence of soybean seedlings was significantly reduced and percentage of emerged infected seedlings was increased. Yields were not reduced. Symptoms on seedlings in field plots appeared first as reddish-brown lesions on the hypocotyls close to the cotyledons, then turned ashy-gray to black. Sclerotial and mycelial inoculum were almost equally effective in causing seedling disease under controlled and field conditions. Seedling disease was greatest at 30 and 35 C although some infections occurred at 20 and 25 C. Infected seedlings may serve as a latent source of inoculum for the mature-plant phase of the disease over a wide temperature range. The percentage of diseased seedlings increased slightly with an increase in number of viable *M. phaseolina* propagules in soil.

1375. MICHELL, R. E., and D. I. EDWARDS. 1973. Susceptibility of soybean to *Meloidogyne naasi*. Plant Dis. Reptr. 57:207–209.

An isolate of the barley root-knot nematode, *Meloidogyne naasi,* parasitized soybeans but was not pathogenic at the highest inoculum level of 8,000 larvae. Nine of 10 soybean cultivars screened for susceptibility to *M. naasi* proved susceptible, although galling was not heavy. Bragg soybean proved to be a nonhost. A small number of galls were observed on Bragg, all of which were devoid of females.

1376. MIKHAILENKO, A. 1965. [Diseases of legumes in the Primorsk region.] Zashch Rast. Vredit. Bolez. 10:41–43.

Descriptions of symptoms of *Cercospora sojina, Peronospora manshurica,* and *Septoria glycines* on soybean. Records the occurrence of *Sclerotinia* (= *Whetzelinia*) *sclerotiorum, Ascochyta sojaecola, Uromyces sojae* (= *Phakopsora pachyrhizi*) and *Phyllosticta sojaecola* on soybeans in Primorsk region of U.S.S.R. Dry seed treatment with granosan, thiram, or mercuran, 1–2 months prior to planting, is recommended.

1377. MILBRATH, G. M., and F. ESKANDARI. 1973. Isolation of peanut stunt virus from soybeans in Illinois. 2nd Internatl. Cong. Plant Path. Abstrs.: 0923.

Soybean leaf samples with and without virus symptoms were collected for bioassay. In addition to recovery of mosaic and tobacco ring spot viruses from individual plants, peanut stunt virus (PSV) was recovered from soybean plants with no visible symptoms. This is the first report of PSV in the Midwest. Inoculations to indicator plants resulted in PSV symptoms including chlorotic local lesions formation in cowpea (*Vigna sinensis*) followed by systemic infection; chlorotic local lesions on red kidney bean (*Phaseolus vulgaris*) and stunting and dwarfing of leaflets in peanut (*Arachia hypogaea*). Physical properties were similar to other PSV strains: dilution end point between 10^{-3} and 10^{-4}, temperature inactivation between 50 and 55 C, and infectivity lost after 24–26 hr. Infected soybeans were difficult to detect in the field and positive identification depends on diagnostic hosts and serological tests. The extent of natural infection in Illinois is not known.

1378. MILLAR, R. L. 1956. Studies on the nature of pathogenicity of *Xanthomonas phaseoli* (E. F. Sm.) Dowson and of *X. phaseoli* var. *sojense* (Hedges) Starr and Burk. Diss. Abstr. 16:426.

Discusses effect of *Xanthomonas phaseoli* on beans and soybeans.

1379. MILLER, A. S. 1941. [El reconocimiento de las enfermendades de las plantas cultivades en Venezuela, 1937–1941.] Soc. Venezolana de Cien. Natl. Bull. 7, pp. 99–113.

Heterodera marioni is reported on soybean in Venezuela.

1380. MILLER, H. N. 1964. Interactions of nematodes and other plant pathogens. Proc. Soil and Crop Sci. Soc. Florida 24:310–325.

A review article dealing with common plant-parasitic nematode genera and their association with other disease organisms. Specifically mentioned are soybean seedlings. Decreased emergence occurred when *Meloidogyne hapla* and *M. javanica* were associated with *Rhizoctonia solani*. Together *M. hapla* and *Phytophthora sojae* produced more severe symptoms on soybeans than either pathogen alone. A brief discussion concerns reduced nodulation on soybean grown in soil infested with *Heterodera glycines*.

1381. MILLER, L. I. 1965. Variation in development of eleven isolates of *Heterodera glycines* on *Beta vulgaris*. Phytopathology 55:1068. (Abstr.)

Isolates of the soybean-cyst nematode from four farms in Virginia and from one farm in each of seven other states were tested to determine their ability to develop egg-bearing females in interaction with Detroit Red garden beet. The experiment was done in the greenhouse in March and April 1965 at an air temperature of 24–30 C. One hundred cysts containing viable eggs from cultures propagated on Lee soybean were introduced into methylbromide-fumigated Ruston loamy-fine sand soil in 4-in. pots. A single garden beet plant or soybean (check) was grown in each pot. Roots were examined 5 weeks after planting and the number of fifth-stage females was counted. On Lee soybean each isolate developed 100–200 females/plant. On garden beet the larvae of all the isolates penetrated the roots, but Va.1, Va.2, Va.3, N.C.1, Ark.1, Tenn.1, and Ill.1 isolates did not form females; Va.4 and Mo.1 isolates formed 1–6 females/plant; and Miss.1 and Ky.1 isolates formed 30–50 females/plant. Ten specimens of Ky.1 isolate from garden beet averaged 477 μ in length (excluding the neck) by 335 μ in width and contained 77 viable eggs/cyst. Ten specimens of Ky.1 isolate from Lee soybean averaged 641 μ in length (excluding the neck) by 467 μ in width and contained 128 viable eggs/cyst.

1382. MILLER, L. I., and P. L. DUKE. 1966. Development of the Virginia 2 population of *Heterodera glycines* on soybeans. Virginia J. Sci. 17:245–246. (Abstr.)

Using the Ross-Brim double-row method and Lee soybean as a susceptible check, the susceptibility of 1,904 soybean lines and cultivars were checked against the Va.2 population of *Heterodera glycines*. No females were found on P.I. 90763 and very few females were found on the following plant introductions: 63468, 81042-1, 84611, 85903, 87631-1, 88788, 88287, 89772, 93686, 206258, 248511, 209331, and the cultivars Pine Dell and Old Dominion.

1383. MILLER, L. I., and B. J. GRAY. 1966. Reaction of lambsquarter, Swiss chard, and spinach to eleven isolates of the soybean cyst nematode. Virginia J. Sci. 17: 246. (Abstr.)

Eleven isolates of *Heterodera glycines* were tested to determine their ability to develop egg-bearing females on lambsquarter, Swiss chard, and spinach. Lee soybean was used as a check. No isolates produced females on lambsquarter or Swiss chard. Va.3 and Mo.1 isolates formed 2–6 females/plant on spinach.

1384. MILLER, L. I. 1966. Maturation of females of *Heterodera glycines* as influenced by inoculum level. Phytopathology 56:585. (Abstr.)

The Mo.1 isolate of the soybean-cyst nematode was used to determine the effect of different levels of inoculum on number of egg-bearing females formed in interaction with five soybean cultivars or lines. Seventy, 245, 857, or 3,000 large cysts (182–235 eggs/cyst) of about the same size from cultures propagated on Lee soybean were introduced into methylbromide-fumigated Galestown loamy-fine sand soil in 4-in. pots. A single soybean plant was grown in each pot at air temperatures of 24–29 C. Roots were examined 5 weeks after planting and number of fifth-stage females was counted. On P.I. 79693 and Lee soybeans, which are relatively good hosts of the Mo.1 isolate, the greatest number of females was formed at inoculum levels of 70 and 245 cysts/pot, respectively. Fewer females were formed at higher inoculum levels. On P.I. 90763 and P.I. 209332 soybeans, which are relatively poor hosts of the Mo.1 isolate, more females formed as inoculum level was increased. No females formed on Peking soybeans at any of the inoculum levels tested. With all cultivars tested, a greater number of larvae penetrated the roots as the inoculum level was increased. There was progressively poorer root development on all soybeans tested as the inoculum level was raised.

1385. MILLER, L. I. 1966. Variation in development of two morphologically different isolates of *Heterodera glycines* obtained from the same field. Phytopathology 56:585. (Abstr.)

Two isolates of the soybean-cyst nematode that differ in length of hyaline tail terminus of the second-stage larva were tested to determine their ability to develop egg-bearing females in interaction with Lee soybean and

Oklahoma-12 mungbean. Both isolates were developed from single cysts selected from an infested field near Suffolk, Va., and were cultured on Lee soybeans and measured prior to use as inoculum. The average, minimum, and maximum lengths of the hyaline tail terminus of 30 second-stage larvae of isolate 1 were 22, 16, and 27 μ, respectively, and of isolate 2 they were 18, 12, and 23 μ. Sixty large cysts (183–217 eggs/cyst) of about the same size were introduced into methylbromide-fumigated soil in 4-in. pots. A single Lee soybean or Oklahoma-12 mungbean was grown in each pot at air temperatures of 24–29 C. Roots were examined 5 weeks after planting, and the fifth-stage females were counted. On Lee soybean, isolate 1 developed 175–293 females/plant and isolate 2 developed 397–534 females/plant. On Oklahoma-12 mungbean, isolate 1 developed 19–30 females/plant and isolate 2 developed 4–7 females/plant. Because the isolates interbreed they should be useful in studies of the mode of inheritance of certain characters of the soybean-cyst nematode.

1386. MILLER, L. I., and P. L. DUKE. 1967. Morphological variation of eleven isolates of *Heterodera glycines* in the United States. Nematologica 13:145–146. (Abstr.)

Comparisons were made of the morphology of isolates of *Heterodera glycines* from four farms in Virginia (Va.1, Va.2, Va.3, Va.4) and from one farm in each of seven other states (N.C.1, Mo.1, Ark.1, Tenn.1, Ill.1, Miss.1, Ky.1). The 11 nematode isolates were reared in the greenhouse at Holland, Va., in March and April 1965 at an air temperature of 24–29 C. One hundred large cysts containing 180–240 eggs/cyst, from 8-week-old cultures propagated on Lee soybean, were introduced into methylbromide-fumigated Ruston loamy-fine sand soil/15 cm pot, and a single Lee soybean was grown in each pot. Soil from the pots was examined for males 6 weeks after planting and for cysts, eggs, and second-stage larvae 8 weeks after planting. One hundred cysts, 100 males, 118 second-stage larvae, and 360 eggs of each isolate were measured for selected morphological characters. The lowest and highest average dimensions (in microns) were as follows: (1) cysts — length excluding neck = 611.6 (Tenn.1)–713.4 (Mo.1); neck length = 69.0 (Ark.1)–120.5 (Ill.1); length including neck = 682.5 (Tenn.1)–824.9 (Mo.1); breadth = 411.1 (Tenn.1)–511.0 (Va.3); (2) eggs — length = 98.0 (Ark.1)–109.8 (Va.2); breadth = 43.2 (Mo.1)–46.2 (Va.1); (3) second-stage larvae — length = 411.4 (Va.1)–460.5 (Ill.1); breadth = 17.9 (Va.2)–18.9 (Ark.1); stylet length = 20.2 (N.C.1); length of posterior part of stylet = 10.9 (Va.4)–12.2 (Ill.1); distance of dorsal gland orifice behind stylet knobs = 3.4 (Va.4)–4.4 (Ill.1); distance anterior end to excretory pore = 90.1 (Va.4)–96.6 (Ill.1); tail length = 38.9 (Va.4)–48.5 (N.C.1); tail terminus length = 17.6 (Ark.1)–26.7 (N.C.1); breadth of tail at anterior portion of tail terminus = 6.9 (Ark.1)–7.5 (Ill.1); tail terminus length/breadth of tail at anterior portion of tail terminus = 2.6 (Ark.1)–3.5 (Ky.1); (4) males — length = 1029.3 (Va.2)–1274.4 (N.C.1); breadth = 23.7 (Ark.1)–25.6 (Tenn.1); stylet length = 24.4 (Miss.1)–26.9 (Va.4); distance of dorsal gland orifice behind stylet knobs = 2.8 (N.C.1)–4.0 (Tenn.1); spicule length = 29.5 (Va.2)–33.2 (N.C.1); tail length = 6.9 (Ark.1)–8.1 (Tenn.1). The lowest and highest average dimensions obtained for each of the characters of the 11 isolates were statistically different ($P < 1\%$). However, the range of measurements overlapped for any two of the 11 isolates for each of the characters compared. Data obtained from the study of morphological variation of the 11 isolates permit an amended range of dimensions for *H. glycines,* and indicate that each of the isolates is a geographic race.

1387. MILLER, L. I. 1967. Comparison of the pathogenicity and development of the Va.2 isolate of *Heterodera glycines* on Pickett and Lee soybeans. Phytopathology 57:647. (Abstr.)

The pathogenicity and development of 11 isolates of the soybean-cyst nematode *Heterodera glycines* were tested against Pickett and Lee soybeans. The Virginia isolate (Va.2) was the only isolate pathogenic on Pickett soybean. All isolates were pathogenic on Lee soybean. Fewer cysts of the Va.2 isolate developed on Pickett than on Lee soybean, but there was no significant difference in size of the cysts and eggs or in number of eggs per cyst formed on the two hosts.

1388. MILLER, L. I., and P. L. DUKE. 1967. Development of eleven isolates of the soybean cyst nematode on four species of the Scrophulariaceae. Virginia J. Sci. 18:143. (Abstr.)

Eleven isolates of *Heterodera glycines* were tested for their ability to develop egg-bearing females on four *Pentstemon* species. None developed on *P. barbatus.* Only the Va.1 isolate produced numerous females on *P. angustifolius.* On *P. ovatus* a few females were produced by the Va.1, N.C.1, Mo.1, Tenn.1, Ill.1, Miss.1, and Ky.1, and a medium number by the Ark.1 isolate. All isolates produced numerous females on *P. wilcoxi,* except Va.2 and N.C.1, which developed a few females, and Va.4 and Miss.1 isolates, which produced a medium number of females. Lee soybean was used as a check.

1389. MILLER, L. I. 1967. Development of 11 isolates of *Heterodera glycines* on six legumes. Phytopathology 57:647. (Abstr.)

Isolates of *Heterodera glycines* from four farms in Virginia (Va.1, Va.2, Va.3, and Va.4) and from one farm in each of seven other states (N.C.1, Mo.1, Ill.1, Ark.1, Tenn.1, Miss.1, and Ky.1) were tested for their ability to develop egg-bearing females on six different legumes. The Va.1, Va.4, Ark.1, Ill.1, and Ky.1 isolates did not develop on any of the legumes; N.C.1 did not develop

on *Trifolium procumbens;* Va.3 and Tenn.1 on *T. incarnatum;* Va.3 on *T. hybridum;* N.C.1 and Miss.1 on *Melilotus hispida;* Va.2, Mo.1, and Miss.1 on *M. orabica;* and Miss.1 on *Glycine javanica.* This is the first report on these legumes as hosts of the *H. glycines.*

1390. MILLER, L. I. 1968. Pathogenicity and development of the Tenn.1 isolate of *Heterodera glycines* on *Antirrhinum majus.* Nematologica 14:10. (Abstr.)

Eleven isolates of *Heterodera glycines* were tested to determine their ability to develop egg-bearing cysts on Snowflake snapdragon. The Va.2, Va.3, Va.4, N.C.1, Mo.1, and Ill.1 isolates did not form cysts on snapdragon, but the Va.1, Ark.1, Miss.1, and Ky.1 isolates formed a few cysts, and the Tenn.1 isolate formed numerous cysts on this plant. Experiments were conducted to determine pathogenicity of Tenn.1 isolate on snapdragon and to compare development of this isolate on snapdragon and soybean. Two hundred large cysts of Tenn.1 isolate containing 115–210 eggs/cyst from 8-week-old cultures propagated on Lee soybean were introduced into each of 20 pots (15 cm) of methylbromide-fumigated Ruston loamy-fine sand soil. In April 1965 each pot received either a single transplanted Snowflake snapdragon seedling or a single seed of Lee soybean. The pots were maintained at an air temperature of 24–29 C. Each treatment, including a snapdragon check in noninfested soil, was replicated 10 times.

The soil was washed from the pots and screened for cysts 2 mo. after the experiment was initiated and the snapdragon plant parts were oven-dried and weighed. The Tenn.1 isolate developed an average of 56 cysts/plant on snapdragon and an average of 74 cysts/plant on soybean. Roots of snapdragon weighed 49% less ($P < 1\%$) from infested soil than from noninfested soil. Weight of the foliar parts of snapdragon was 19% less ($P < 5\%$) from infested than from noninfested soil. Twenty cyst specimens of Tenn.1 isolate formed on snapdragon averaged 511 μ in length (excluding the neck) by 399 μ in breadth and contained an average of 136 eggs/cyst. Twenty cyst specimens of Tenn.1 isolate from soybean averaged 586 μ in length (excluding the neck) by 379 μ in breadth and contained an average of 122 eggs/cyst. Of these measurements only the length varied significantly. Average length of cysts formed on soybean was significantly greater ($P < 1\%$) than that of cysts formed on snapdragon. Average length and breadth of 100 eggs of Tenn.1 isolate from cysts formed on soybean ($99\ \mu \times 46\ \mu$) were significantly greater ($P < 1\%$) than length and breadth of eggs from cysts formed on snapdragon ($99\ \mu \times 39\ \mu$). Average length of 50 larvae of Tenn.1 isolate from cysts formed on soybean (408 μ) was significantly greater ($P < 1\%$) than length of larvae from cysts formed on snapdragon (360 μ).

1391. MILLER, L. I. 1969. Physiologic variation of five isolates of the soybean cyst nematode. Virginia J. Sci. 20:99. (Abstr.)

Five isolates of *Heterodera glycines* were differentiated by their ability to reproduce on the following cultivars: *Vicia villosa* Madison, *Phaseolus aureus* Kiloga, *P. vulgaris* Bountiful, and *Glycine ussuriensis.*

1392. MILLER, L. I. 1969. Correlation of pairs of morphometric characters of eleven isolates of *Heterodera glycines.* J. Nematol. 1:297–298. (Abstr.)

Correlation of pairs of morphometric characters were made of 11 isolates of *Heterodera glycines* reared in the greenhouse (24–29 C) to determine whether the use of ratios was justified in characterization of the isolates. One hundred cysts containing 180–240 eggs/cyst were introduced into methylbromide-fumigated soil in 15 cm pots and a single Lee soybean plant was grown in each pot. Soil from the pots was examined for males 6 weeks after planting and for cysts, eggs, and second-stage larvae 8 weeks after planting. Measurements were made of selected morphometric characters of 100 cysts, 360 eggs, 100 males, and 108 second-stage larvae of each isolate. Measurements of the characters were compared as to correlative relationship (significant values $P < 1\%$): (1) Cysts — breadth (BR) with neck length (NK) and NK with length without neck (LWON) were not mutually related; NK to length with neck (LWN) were significantly correlated in 8 of the 11 isolates but highest correlation coefficient (r) for the Virginia (Va.) 4 isolate was only 0.54. LWN with BR was significantly correlated in all isolates, the lowest r was 0.32 for Missouri (Mo.) 1 and highest r 0.71 for Tennessee (Tenn.) 1. LWON with BR was also significantly correlated in all isolates; the lowest r was 0.38 for Illinois (Ill.) 1 and the highest r 0.74 for Va. 3. (2) Eggs — L and BR were not mutually related for the combined data of the 11 isolates and only Va. 4 exhibited a significant r of 0.62. (3) Males — no reciprocal relation was found for the 11 isolates or for the combined data of all isolates in comparisons of L with: BR, stylet length (S), and spicule length (SP); BR with: S, tail length (T) and SP; S with: T and SP. (4) Larvae — BR with: S, posterior part of stylet (PS), head to excretory pore (EP). T, tail terminus length (TT), and breadth of tail at anterior portion (BT) were not mutually related.

The same characters compared with L exhibited significant r values for several or all of the isolates, but the reciprocal relation between them was least for L with BR, S, PS, BT, and greatest for L with EP (max. r, Ill. 1 = 0.84); T (max. r, Ill. 1 = 0.68). S with PS, EP, T, TT, and BT exhibited significant r values for several or all of the isolates, and the relation between them was least for S with BT; a medium relationship of S with: EP (max. r, Ill. 1 = 0.52), T (max. r, Tenn. 1 = 0.40), TT (max. r, Arkansas 1 = 0.47); and the highest relation for S was the PS (max. r, Ark. 1 = 0.72). A recip-

rocal relation occurs between T and TT for all isolates (min. *r*, Va. 3 = 0.62 and max. *r*. Va. 1 = 0.80) but none of the isolates showed significant *r* values for T with BT. TT and BT were not mutually related. Since only a few of the pairs of morphometric characters had a high degree of correlation for all isolates, the use of ratios to characterize isolates of *H. glycines* is limited.

1393. MILLER, L. I. 1969. Physiologic variation of six isolates of *Heterodera glycines*. Phytopathology 59:1588. (Abstr.)

Each of six isolates (Va.1, Va.2, N.C.1, Ark.1, Tenn.1, Ill.1) of *Heterodera glycines* tested proved to be a distinct race differentiated by its ability to develop egg-bearing females on six different cultivars: *Glycine max* Lee, *G. gracilis, Cassia tora, Trifolium hybridum* F.C. 34088, *Vicia sativa* Warrior, and *Pentstemon grandiflorus.* Seventy cysts (190–257 eggs/cyst) were introduced into methylbromide-fumigated Ruston loamy-fine sand soil in 4-in. pots. Single seeds were planted of genera *Glycine* and *Cassia,* or three 1-mo.-old seedlings of genera *Trifolium, Pentstemon,* and *Vicia* were transplanted to each pot and grown at air temperatures of 24–29 C. Each treatment was replicated four times. After 5 weeks the soil was screened for females. Va.1 formed 65–75 females on *P. grandiflorus,* the other isolates 0–3. Va.2 formed 3–7 females on *T. hybridum,* the other isolates none. N.C.1 formed 20–30 females on *V. sativa,* the other isolates 0–1. Ark.1 formed 145–185 females on *G. max,* the other isolates 45–72. Tenn.1 formed 0–1 females on *G. gracilis,* the other isolates 28–111. Ill.1 formed 14–22 females on *C. tora,* the other isolates none.

1394. MILLER, L. I. 1970. Differentiation of eleven isolates as races of the soybean cyst nematode. Phytopathology 60:1016. (Abstr.)

Eleven isolates of *Heterodera glycines* (Va.1, Va.2, Va.3, Va.4, N.C.1, Mo.1, Ark.1, Tenn.1, Ill.1, Miss.1, Ky.1) each proved to be a distinct race, differentiated by its ability to develop egg-bearing females on the following cultivars or plant introductions of *Glycine max*: Peking, Pine Dell, P.I. 90763, P.I. 88788, P.I. 87631-1, P.I. 79693, P.I. 91684, and P.I. 84611. The lines P.I. 91684 and P.I. 79693 were efficient hosts for Va.1, Mo.1, and Ark.1. These isolates were differentiated on P.I. 87631-1 and Pine Dell; P.I. 87631-1 was an efficient host for Mo.1 and a poor host for Ark.1 and Va.1; Pine Dell was an efficient host for Ark.1 and a poor host for Va.1. Isolates Va.3, Va.4, N.C.1, and Miss.1 formed numerous females on P.I. 91684 and few females on P.I. 79693, and were differentiated on P.I. 87631-1, P.I. 88788, and P.I. 84611. P.I. 87631-1 was an efficient host for N.C.1 and a poor host for Va.3, Va.4, and Miss.1; P.I. 88788 was an efficient host only for Va.3; P.I. 84611 was an efficient host for Miss.1 but not for Va.4. Isolates Va.2, Tenn.1, Ky.1, and Ill.1 formed few females on P.I. 91684, and were differentiated on Peking, P.I. 90763, and P.I. 79693. On Peking only, Va.2 formed females; P.I. 90763 was an efficient host only for Ky.1; Tenn.1 formed numerous females on P.I. 79693, and on Ill.1 only a few.

1395. MILLER, L. I. 1970. Intraspecific variation in *Heterodera glycines*. 10th Internatl. Nematol. Symp., Eur. Soc. Nematol., Pescara, pp. 10–11. (Abstr.)

1396. MILLER, L. I. 1971. Physiologic variation within the Virginia-2 population of *Heterodera glycines*. J. Nematol. 3:318. (Abstr.)

Physiologic variation of single cyst cultures of *Heterodera glycines* from seven selected areas within a field of the Va.2 population was compared to a composite culture (CVa.2 = race 2, designated by the Terminology Committee at the 1969 Soybean Cyst Nematode Workshop) started from cysts from the entire field. Comparisons were made of ability of the cultures to develop egg-bearing females in interaction with the following cultivars or plant introductions of *Glycine max*: Lee, Peking, P.I. 90763, and P.I. 79693. Seventy cysts, each containing 185–250 eggs/cyst, from 8-week-old cultures of single-cyst isolates (C1, C2, C3, C4, C5, C6, C7) and CVa.2 propagated on Lee, were introduced into methylbromide-fumigated Ruston loamy-fine sand soil in 10-cm pots. A single seed of each soybean cultivar or plant introduction was planted in each pot and greenhouse-grown at air temperatures 24–29 C. Each treatment was replicated four times. After 5 weeks the soil in each pot was screened and the mature females were counted. Based on criteria established by the 1969 Terminology Committee [positive rating (+) more than 10%, negative rating (−) less than 10% of the reproduction on Lee], five races could be distinguished among the seven single-cyst cultures and the CVa.2 culture. Average reproductive ratings of cultures on Peking, P.I. 90763, and P.I. 79693, respectively, were C1 = −, −, +; C2, C4, C7 = +, +, +; C3, C5 = −, −, −; C6 = +, −, −; CVa.2 = +, −, +. Average number of females/pot produced by the cultures on Lee were C4 = 34; CVa.2 = 63; C2 = 81; C7 = 107; C6 = 196; C3 = 247; C1 = 605; C5 = 750. Four different ($P < 1\%$) groups could be distinguished with respect to number of females formed on Lee from these data: (i) C4, CVa.2, C2, C7; (ii) C6, C3; (iii) C1; (iv) C5. Since levels of reproduction of different isolates of *H. glycines* may vary greatly on Lee, it is questionable whether this cultivar should be used as a standard to compute the reproductive rating of other cultivars and lines of *G. max*.

1397. MILLER, P. R., and J. I. WOOD. 1947. An evaluation of certain phases of the Emergency Plant Disease Prevention Project. Plant Dis. Reptr. Suppl. 167:1–26.

During the Emergency Plant Disease Prevention Project surveys, seven new diseases were found on soybean,

caused by *Helminthosporium vignae* (= *Corynespora cassicola*), *Microsphaera* sp., *Myrothecium roridum, Nematospora coryli, Penicillium* sp., *Phyllosticta sojaecola,* and *Pseudomonas tabaci.* Another disease, bud blight (tobacco ring spot virus), was found in states where it had not previously been known to occur.

1398. MILLER, P. R., and N. W. NANCE. 1949. Preliminary estimates of acreages of crop lands in the United States infested with some organisms causing plant diseases. Plant Dis. Reptr. Suppl. 185:207–252.

1399. MILLER, P. R. (comp.). 1953. Plant disease situation in the United States. Food and Agr. Org. Plant Prot. Bull. 2, pp. 24–27.

Records the prevalence of the following pathogens on soybeans: *Xanthomonas phaseoli, Pseudomonas glycinea, P. tabaci, Peronospora manshurica, Corynespora cassicola, Cercospora sojina, C. kikuchii, Sclerotium bataticola* (= *Macrophomina phaseolina*), *S. rolfsii, Colletotrichum* sp., *Phyllosticta* sp., *Alternaria* sp., soybean mosaic virus, and yellow bean mosaic virus.

1400. MILLER, W. O., P. A. THOMAS, and M. G. MORRIS. 1971. Nematode diseases of soybeans and the economics of their control with fumazone nematicide. Down to Earth 26(4):25–27.

Fumazone 86 was shown to be a practical and economical method of controlling nematodes associated with soybeans.

1401. MILLIKAN, D. F., T. D. WYLLIE, and E. E. PICKETT. 1965. Some comparative biochemical changes associated with downy mildew infection in soybean. Phytopathology 55:932.

Ribonucleic acid and deoxyribonucleic acid synthesis is affected in soybean leaves infected with *Peronospora manshurica.*

1402. MILNER, M., and W. F. GEDDES. 1946. Grain storage studies. IV. Biological and chemical factors involved in the spontaneous heating of soybeans. Cereal Chem. 23:449–470.

Spontaneous heating and associated respiratory characteristics of soybeans at humidity levels favorable to mold growth but unfavorable to bacterial proliferation were studied in an apparatus that maintained continuously controlled adiabatic and aeration conditions, over time intervals up to 37 days. An initial temperature increase to 50–55 C and parallel respiratory increase were directly associated with proliferation of the molds *Aspergillus glaucus* and *A. flavus.* A secondary spontaneous heating phase due to nonbiological oxidation was demonstrated, which appeared to have no limit short of ignition temperatures, and was closely paralleled by the extent of CO_2 evolution. Surface sterilization of the seeds failed to eliminate mold infection, whereas inoculation of autoclave-sterilized soybeans with spores of *Aspergillus flavus* yielded heating and respiration curves virtually identical to those of normal seeds.

Spontaneous heating of sterile seeds in which no microfloral activity had occurred was demonstrated. Chemical changes in the heated seeds assayed at intervals in the course of the trials indicated a disappearance of total sugars in the initial biological phase of heating and an increase in reducing substances in the initial spontaneous chemical heating phase. The petroleum ether-soluble fraction remained virtually unchanged in the biological heating stage but decreased markedly in the chemical heating phase, without a corresponding loss in dry matter content of the seeds. Respiratory quotients associated with the gas exchange during the spontaneous chemical heating phase suggest the occurrence of thermally induced oxidative cleavage of carbohydrates as well as oxidative polymerization of the seed oils.

1403. MINTON, E. B., A. L. SMITH, and E. J. CAIRNS. 1960. Population build-up and pathogenicity of reniform, root-knot, lance, and spiral nematodes on cotton, soybean, and tomato in field bins. Phytopathology 50:576. (Abstr.)

Following eradication of existing nematodes in field bins, duplicate bins were reinfested in July 1958 with single-species cultures of the nematodes *Meloidogyne incognita incognita, M. incognita acrita, Rotylenchulus reniformis, Rotylenchus brachyurus, Helicotylenchus nannus,* and *Hoplolaimus tylenchiformis.* Noninfested bins were used for controls. Plains cotton, Rutger's tomato, and Lee soybean were planted intermingled in rows throughout all bins in July 1958. The following fall, Auburn woolly-pod vetch was planted, followed by 10 entries of cotton ranging from very susceptible to highly resistant to cotton root-knot nematode. The average nematode counts per pint of soil one year after seeding the pure colonies were: *R. reniformis* 132,000; *R. brachyurus* 1,307; *M. incognita incognita* 456; *M. incognita acrita* 278; *H. tylenchiformis* 9; and *H. nannus* 7. The reniform nematode was pathogenic on all entries of cotton and caused stunting, delayed maturity, and reduced yield. Cultures of the two root-knot nematodes were found to be pathogenic to tomato and soybean, but were only weakly pathogenic to cotton. In 1959, *M. incognita acrita* stimulated growth, hastened maturity, and increased cotton yield.

1404. MINTON, N. A., and E. J. CAIRNS. 1957. Suitability of soybeans var. Ogden and 12 other plants as hosts of the spiral nematode. Phytopathology 47:313. (Abstr.)

Various crop plants and weeds frequently found in Alabama where *Helicotylenchus nannus* Steiner 1945 occurs were tested in the greenhouse as hosts. Three soybean plants were grown 120 days in each of 40 pots (8-in.) containing sterilized soil. Twenty pots were infested with 500 spiral nematodes each at time of planting and 20

were not. Five additional pots kept free of vascular plants were infested with 500 spiral nematodes each. The dry weight of roots of inoculated plants was less (statistically significant at the 5% level) than that of the controls. The difference between seed yields of the inoculated and noninoculated plants was not significant. The nematode population had multiplied by an average of 10.6 in pots containing soybean plants, whereas an average of only 15 nematodes per pot survived in the absence of vascular plants. The spiral nematodes were found to multiply in similar greenhouse tests with the following 12 kinds of plants; cotton, ladino clover, oats, grain sorghum, Dallis grass, Bermuda grass, nut grass, Johnson grass, fescue, sweet sudan, and orchard grass. Under conditions of the experiment, *H. nannus* was not found to be visibly pathogenic on any of the plants tested except soybean cultivar Ogden. Root penetration by the nematodes occurred only in fescue.

1405. MINTON, N. A., E. J. CAIRNS, E. B. MINTO, and B. E. HOPPER. 1963. Occurrence of plant-parasitic nematodes in Alabama. Plant Dis. Reptr. 47:743–745.

Aphelenchoides spp., *Criconemoides* spp., *Hoplolaimus* spp., *Meloidogyne* spp., *Pratylenchus* spp., *Helicotylenchus* sp., *Trichodorus* spp., *Tylenchorhynchus* sp., and *Xiphinema* spp. were found to be associated with soybeans.

1406. MINTON, N. A., and M. B. PARKER. 1974. Yields of six soybean cultivars following fumigation of soil infested with root-knot nematode. Phytopathology 64:219–221.

Nematode control, plant height, and yield of six soybean cultivars were compared in *Meloidogyne incognita*-infested soil with and without 1,2-dibromo-3-chloro-propane (DBCP) fumigation. Yield differences among soybean entries grown in nonfumigated soil were closely related to root-knot indices, indicating a wide range of susceptibility to nematode attack and effect on yield. Cultivars tested were classified as follows: very tolerant — Bragg; susceptible — McNair 800 and Davis. Two-year mean yields of Hutton and Coker 68-41 in nonfumigated plots were significantly greater than yields of McNair 800. Yield of Hutton was also significantly greater than those of Bragg and Davis. Yields of all entries except Hutton and Hampton 266A were significantly increased by fumigation. Differences in yield among entries in fumigated plots were not significant. Root-knot indices were more accurate indicators of plant damage than larval populations. Differences in plant height between fumigated and nonfumigated plots were closely related to root-knot indices.

1407. MINZ, G. 1953. Plant parasitic nematodes [in Hebrew, English summary]. Min. Agr., Agr. Res. Sta., Rehovot, Israel. 38 pp.

Meloidogyne spp. reported in Israel on Creole, Laredo, and Malaga soybeans.

1408. MINZ, G. 1958. Root-knot nematodes *Meloidogyne* spp. in Israel. Israel Min. Agr., Div. Plant Path., Spec. Bull. 12. 10 pp.

Meloidogyne spp. reported on soybean cultivars Creole, Laredo, and Malaga.

1409. MISHRA, A. B., S. M. SHARMA, and S. P. SINGH. 1969. Studies on the seed mycoflora of soybean, *Glycine max* (L.) Merrill. J. Appl. Sci. India 1:52–53.

Of the 11 cultivars of soybean seeds tested for seedborne microorganisms *Alternaria* spp., *Fusarium* spp. were associated with few cultivars while *Rhizoctonia* and *Curvularia* spp. were common. In pathogenicity tests, *Rhizoctonia* spp. and *Fusarium* spp. were more virulent than *Alternaria* or *Curvularia.* Seed treatment with cerasan dry, agrosan GN, and tillex was more effective than harvesan, rhizoctol, arasan, and fytolan.

1410. MITRA, M. 1936. Report of the imperial mycologist. Agr. Res. Inst., Pusa, Sci. Rpt. 1933–1934, pp. 139–167.

A *Cercospora* found on leaf, stem, and pod of soybeans in India does not agree with *C. daizu* (= *C. sojina*).

1411. MIURA, M. 1921. [Diseases of the main agricultural crops of Manchuria.] So. Manchuria Railway Co. Agr. Expt. Sta. Bull. 11. 56 pp. [In Japanese, English abstr., Japan. J. Bot. 1:9 (1922).]

First report of downy mildew in the world. The causal organism was identified as *Peronospora trifoliorum.*

1412. MIURA, M. 1930. Diseases of the main agricultural crops in Manchuria [in Japanese]. Manchuria Railway Co. Agr. Expt. Sta. Bull. 11 (rev. ed.). 56 pp.

Symptoms, causes, and control measures are given for diseases caused by the following pathogens: *Bacterium sojae* var. *japonicum* (= *Pseudomonas glycinea*), *Peronospora manshurica, Sclerotinia libertiana* (= *Whetzelinia sclerotiorum*), *Gibberella* sp., *Hypochnus centrifugus, Uromyces sojae* (= *Phakopsora pachyrhizi*), *Septoria glycines, Cercospora sojina, Cercosporina* (= *Cercospora*) *kikuchii, Heterodera schachtii, Pleosphaerulina sojaecola,* and *Cuscuta chinensis.* Other diseases not occurring in Manchuria are also noted.

1413. MIYAGI, J. 1936. Studies on purple and brown spots on soybean seeds [in Japanese]. Proc. Crop Sci. Soc. Japan 8:65–82.

Gives no organism but states that some authors consider *Fusarium* sp. or *Cercosporina* (= *Cercospora*) *kikuchii* as the cause of the disease.

1414. MIYASAKA, S. 1954. Soybean improvement. I. Preliminary observations on the behavior of some soy-

bean varieties in São Paulo, Brazil [in Portuguese, English summary]. Bragantia 14:9–17.

Observations were made on resistance of 18 soybean cultivars from São Paulo and foreign countries to bacterial pustule (*Xanthomonas phaseoli* var. *sojense*).

1414a. MOFFET, M. L., et al. 1972. Wildfire and bacterial blight on soybean in Queensland. Search 3:336.

1415. MOLNAR, B., and J. VOROS. 1963. Soybean stem rot caused by *Sclerotinia sclerotiorum* (Lib.) de Bary in Hungary [in Hungarian, English summary]. Novenytermeles 12:51–56.

In Hungary in 1962, stem rot occurred sporadically in the cultivar trials. The pathogen occurred primarily in irrigated plots on soybeans following sunflower. Under irrigation, Harosoy, Clark, Ford, and a cultivar from Farmer City, Ill., are particularly susceptible, the stem rot incidence being 7–14%. In cultivars generally grown in Hungary the disease appears only sporadically and seems not to be especially dangerous.

1416. MOORE, B. J., H. SCOTT, and H. J. WALTERS. 1969. *Desmodium paniculatum,* a perennial host of bean pod mottle virus in nature. Plant Dis. Reptr. 53:154–155.

Desmodium paniculatum is the natural host of bean pod mottle virus. Extract of infected leaves, when inoculated on Hill and Hood soybean, produced typical symptoms of the disease.

1417. MOORE, B. J., and H. A. SCOTT. 1970. A comparison of type bean pod mottle virus with a closely related strain from Arkansas. Phytopathology 60:585. (Abstr.)

An isolate of bean pod mottle virus, designated as J-10, collected from soybean did not differ in host range from type bean pod mottle virus (T-BPMV), but differed in symptomatology in certain hosts. Black Valentine bean and Hill soybean infected with J-10 showed more severe leaf distortion and more pronounced stunting, and *Chenopodium quinoa* developed chlorotic ring spots on inoculated leaves followed by systemic invasion, whereas T-BPMV remained localized in the inoculated leaves. Gel diffusion tests with T-BPMV antiserum resulted in spur formation indicating a serological difference. Purified J-10 preparations contained two immunoelectrophoretic components and three centrifugal components (top, middle, and bottom) which migrated at the same rates as those of T-BPMV. Middle and bottom components from T-BPMV and J-10 were separated by density-gradient centrifugation and inoculated on Pinto bean either singly or as mixtures. Heterologous mixtures of middle and bottom components resulted in several-fold increases of infectivity, and were equal in infectivity to homologous mixtures. Any of 28 and 8 of 24 bean leaf beetles, *Ceratoma trifurcata,* transmitted J-10 and T-BPMV, respectively.

1418. MOORE, B. J., and H. A. SCOTT. 1971. Properties of a strain of bean pod mottle virus. Phytopathology 61:831–833.

J-10, a strain of bean pod mottle virus (BPMV), was efficiently transmitted by bean leaf beetle, had the same host range as BPMV, and contained the three typical centrifugal components. J-10 differed from BPMV serologically and in the symptoms produced in *Chenopodium quinoa.* Separation of middle (M) and bottom (B) centrifugal components of both virus isolates, and remixing, increased lesion counts, whether the mixtures were homologous or heterologous. Soybean plants were inoculated with extracts from local lesions obtained from homologous and heterologous combinations of the M and B of J-10 and BPMV. The mixtures containing J-10 M produced infections that gave serological reactions characteristic of J-10 virus, indicating that genetic information for antigenic characteristics of the protein is carried by M.

1419. MOORE, E. S. 1930. Internal boll disease of cotton in South Africa. South Africa Dept. Agr. Sci. Bull. 94, pp. 11–18.

Soybean seeds were infected naturally by *Nematospora coryli* and *N. gossypii.*

1420. MORGAN, F. L. 1963. Bacterial pustule of soybeans. Soybean Dig. 23:8–9.

A popular article. Incubation period for symptom development of bacterial pustule is 5–7 days. Infected cells become larger and divide faster. Increased growth in localized areas results in pustule formation. Cultivars CNS, Scott, Hill, Hood, Lee, Hampton, and Hardee are resistant.

1421. MORGAN, F. L. 1963. Soybean stem and leaf infections by *Phytophthora megasperma* var. *sojae.* Plant Dis. Reptr. 47:880–882.

Leaves and stems of soybean were infected by *Phytophthora megasperma* var. *sojae.* Susceptible plants leaf-inoculated with the pathogen on cotton became systemically infected; resistant leaves similarly inoculated also became infected but infection remained localized. Field-tolerant and susceptible plants in the field became infected when clay naturally infested with the fungus was placed in branch axils. Natural inoculum in clay infected plants more frequently than pure cultures of the pathogen. Symptom development was more rapid and extensive when naturally infested clay was used. Natural leaf infection that resulted from inoculum in clay occurred during June 1963. Symptoms of naturally infected plants were similar to those that developed on artificially inoculated plants.

1422. MORGAN, F. L. 1964. Infection of cranesbill by the soybean *Phytophthora.* Plant Dis. Reptr. 48:140–141.

Geranium carolinianum was infected readily by an isolate of *Phytophthora megasperma* var. *sojae* from soybean. Seventy-five percent of the petiole-inoculated seedlings developed lesions of varying size. Approximately 10% of these appeared as susceptible as soybean to *P. megasperma* var. *sojae.* Susceptible cranesbill plants develop green, water-soaked lesions similar to those on soybean. In addition, rotting of crown and roots and reddening of the lower leaves are typical of infected plants. Resistance to *P. megasperma* var. *sojae* in cranesbill appears to be associated with a red substance similar to that reported in soybean. Suitability of cranesbill as a natural host of the soybean *Phytophthora* is unknown, but greenhouse studies indicate that 10% of the seed may rot before germination and 5% or more of the seedlings damp-off when seeds are planted in artificially infested soil.

1423. MORGAN, F. L., and H. W. JOHNSON. 1964. Leaf symptoms of soybean anthracnose. Phytopathology 54:625. (Abstr.)

A disease that girdled petioles and caused leaf blades to shed, leaving only the shriveled petioles attached, was widespread on all soybean cultivars observed in the mid-South during July and August 1963. The symptoms were not typical of any soybean disease. The petiole lesions resembled target spot but occurred earlier. Two anthracnose fungi were associated. Isolations on PDA were identified as *Colletotrichum truncatum* (Schw.) Andrus and W. O. Moore (*C. glycines* Hori), and those on oatmeal-dextrose agar as *Glomerella glycines* (Hori) Lehman and Wolf. Conidia were studied on propylene oxide-sterilized soybean petioles. Those of *C. truncatum* were curved; those of *G. glycines* straight (*C. destructivum* O'Gara). Soybean and lima bean were inoculated in the greenhouse with conidia of each fungus. Leaf veins, petioles, and stems of each species were infected by *C. truncatum* but not by *G. glycines.* Soybeans were most severely affected and symptoms were similar to those in the field. Leaf rolling also occurred. *C. truncatum* was reisolated from diseased plants. Soybean anthracnose has been reported on seedlings in spring and on stems and pods in the fall. This work shows that *C. truncatum* also causes lesions on soybean petioles in summer.

1424. MORGAN, F. L., and E. E. HARTWIG. 1964. *Pythium aphanidermatum,* a virulent soybean pathogen. Phytopathology 54:901. (Abstr.)

Pre- and postemergence killing of soybean (*Glycine max*) in natural soil in the greenhouse was caused by *Pythium aphanidermatum.* When isolates of *P. aphanidermatum* from soybean, *P. ultimum,* and *Phytophthora megasperma* var. *sojae* were mixed in soil, emergence of soybean was reduced more than 90% by each. Soil isolates of *P. aphanidermatum* reduced emergence 40%. Soybean (Lee) inoculated in the hypocotyl with *P. aphanidermatum* from soil and from soybean and with *P. ultimum,* respectively, collapsed within 16–20 hr. Plants similarly inoculated with the *Phytophthora* species collapsed within 24–36 hr. Rye grass, cucumber fruits, and snap bean were vigorously attacked by the isolate of *P. aphanidermatum* from soybean. There appears to be no previous report of this species attacking soybean. Results obtained from these studies show that all isolates of *P. aphanidermatum* are virulent when wounded soybean plants are inoculated, and isolates from soil and from soybean differ in virulence to seeds and seedlings. All isolates of *P. aphanidermatum* from clay tested in artificially infested soil were less virulent to soybean than the isolates from soybean. Therefore it appears that there are strains of *P. aphanidermatum* that differ in virulence to soybean.

1425. MORGAN, F. L., and E. E. HARTWIG. 1965. Physiologic specialization in *Phytophthora megasperma* var. *sojae.* Phytopathology 55:1277–1279.

Isolates of *Phytophthora megasperma* var. *sojae* were grouped in two physiologic races on the basis of pathogenicity to selected soybean strains. Race 1, isolated from D55-1492 and Lee soybeans, was innocuous to D60-9647, D60-11082, FC31745, Harrel, and Nansemond soybeans. Race 2, isolated from D60-9647, was highly virulent to the above strains. Soybean strains previously classified as susceptible to race 1 were equally susceptible to race 2. Strains that were resistant to race 1 and susceptible to race 2 either originated as farmers' selections in Virginia or had one of the selections as a parent. Twenty soybean strains were resistant to both races. The races were morphologically indistinguishable, had similar rates of growth at 5 and 35 C, and grew most rapidly at 28 C.

1426. MORGAN, F. L., and J. M. DUNLEAVY. 1966. Brown stem rot of soybeans in Mexico. Plant Dis. Reptr. 50:598–599.

Report of the occurrence of brown stem rot in Mexico. The fungus produces synnemata on the outside of the vascular tissues of soybeans.

1427. MORGAN, O. D. 1964. Experimental infection of *Nicotiana* species and interspecific crosses with *Cercospora nicotianae* and *Cercospora kikuchii.* Plant Dis. Reptr. 48:693–695.

Cercospora kikuchii from soybean infected 14 of 25 of *Nicotiana* spp., and all of 10 crosses. *C. nicotianae* from tobacco infected all *Nicotiana* spp. and crosses, but not soybean.

1428. MORRIS, G., and M. C. MCDANIEL. 1970. Nematicides increase soybean yields on soybean cyst nematode infected lands. Down to Earth 25(3):4–5.

In Arkansas the most economical practice is to plant a resistant cultivar, as long as such is available, on soybean-cyst nematode infested soils. Another economic consideration tested in Arkansas is the rotation of a nonhost crop for 1–2 years before planting soybeans. Pickett soybeans are susceptible to a new race of soybean-cyst and other nematodes such as root-knot. In areas that have high cyst and root-knot nematode populations, use of a nematicide can increase yields and make soybeans a profitable crop.

1429. MORSE, W. J., and J. L. CARTER. 1939. Soybeans: culture and varieties. U.S. Dept. Agr. Farmers' Bull. 1520.

A popular account including discussions on the following diseases: Purple spot of seeds, bacterial blight, bacterial pustule, mosaic, wilt, brown spot, sunburn or aphid injury, downy mildew, pod and stem blight, anthracnose, sclerotial stem rot, frog-eye spots, and Pythium root rot.

1429a. MORSE, W. J., J. L. CARTER, and L. F. WILLIAMS. 1949. Soybeans: culture and varieties. U.S. Dept. Agr. Agr. Res. Serv. Farmers' Bull. 1520 (rev.). 38 pp.

1430. MORTON, D. J., and W. H. STROUBE. 1955. Antagonistic and stimulatory effects of microorganisms upon *Sclerotium rolfsii.* Phytopathology 45:417–420.

Bacillus subtilis, Streptomyces sp., and *Trichoderma* spp. inhibited the growth of *Sclerotium rolfsii* in culture and reduced the severity of sclerotial blight in soybeans on greenhouse tests.

1431. MORWOOD, R. B. 1956. A preliminary list of plant diseases in Fiji. Fiji Dept. Agr., Agr. J. 27:51–54.

Reports the occurrence of *Sclerotium rolfsii* on soybeans.

1432. MOTSINGER, R. E., J. L. CRAWFORD, and S. S. THOMPSON. 1974. Survey of cotton and soybean fields for lance nematodes in east Georgia. Plant Dis. Reptr. 58(4):369–373.

Cotton and soybean yields have been low in southeast Georgia. Much of the yield reduction was being attributed to the lance nematode *Hoplolaimus columbus.* A random survey of 306 cotton and soybean fields in 14 counties of southeast Georgia was conducted to determine extent of infestation of the Columbia lance nematode. Lance nematodes were found in only eight fields scattered over three counties. This represented 2.6% of the samples or about 7,800 acres. Reniform nematodes, *Rotylenchulus reniformis,* were found in 1.6% of the samples but were present in only three counties. Root-knot nematodes (*Meloidogyne* spp.) were the most prevalent nematode species being found in 73 fields or 23.2% of the samples. Neither soybean-cyst nematodes (*Heterodera glycines*) nor sting (*Belonolaimus* spp.) were found in the survey. A second survey of only problem fields yielded a higher incidence of the same genera. Hardpan, low pH, and nutritional factors are involved and may be equally or more important than nematodes.

1433. MOUNTAIN, W. B. 1954. Studies on nematodes in relation to brown root rot of tobacco in Ontario. Canad. J. Bot. 32:757–759.

The effect of previous crops upon growth of tobacco and populations of *Pratylenchus* was studied in brown root-rot investigations in Ontario. When tobacco was grown in Harrow sandy loam after 6 years of soybeans, 346 *Pratylenchus*/g of tobacco root were found. This was a mixed population of *P. minyus* and the clover *Pratylenchus.* Growth data for tobacco after soybeans could not be included because of the occurrence of blue mold.

1433a. MOUSTAFA, A. M., and T. D. WYLLIE. 1974. Preliminary studies on overwintering and survival of *Macrophomina phaseolina.* Proc. Amer. Phytopath. Soc. 1:127. (Abstr.)

The ability of *Macrophomina phaseolina* to survive winter 1973–1974 was determined by the numerical estimation of propagules isolated from random locations in two test fields, and the numbers of propagules (sclerotia and/or mycelium) was determined by dilution plate count on selective medium. The number of propagules declined from a November high of approximately 60,000 propagules/g on dried tissue to a low of 15,000 propagules/g air-dried tissue in February and March. By May the number again increased to approximately 60,000 propagules/g tissue. These data suggest that with an increase in air and soil temperature, the residual *M. phaseolina* population re-initiates growth resulting in formation of a significant number of detectable propagules. The nature of these propagules is not definitely established, but it is thought to be primarily the formation of new sclerotia. Infected soybean stubble appears to be one of the major sources of inoculum of *M. phaseolina* for seedling infection in the spring.

1434. MUKASA, K., and M. ICHINOHE. 1952. A study of the nematode-disease index to soybean varieties using the relative index system [in Japanese, English summary]. Hokkaido Natl. Agr. Expt. Sta. Res. Bull. 63, pp. 117–120.

Varietal susceptibility to yellow dwarf, caused by cyst nematode, was differentiated by using a relative index system used for root-knot nematode, which was applicable to this disease. Fourteen cultivars were tested.

1435. MUKHERJEE, D. 1965. The inheritance of resistance to bacterial blight in soybeans. Diss. Abstr. 26: 43.

Cultivars Acme, Flambeau, and P.I. 68708 were susceptible to an isolate of *Pseudomonas glycinea* from St. Paul and one from Morris. Harosoy and P.I. 132207 were resistant to the former only, Norchief was resistant to

the former and partially resistant to the latter in the greenhouse but susceptible to it in the field, and P.I. 189968 was resistant to both. Tests on the F_3 of three resistant × susceptible crosses indicated that resistance to the St. Paul isolate was controlled by a single dominant gene and to the Morris isolate by two dominant genes. The reactions of Norchief and Harosoy suggest that the St. Paul gene is different from the Morris gene. The differential reaction of the isolates indicates that they are distinct races. If many races are found, the development of multiline rather than single line resistance may be necessary.

1436. MULLER, A. S. 1934. Brazil: Preliminary list of diseases of plants in the state of Minas Geraes. Internatl. Bull. Plant Prot. 8:193–198.

Includes *Bacterium sojae* (= *Pseudomonas glycinea*) on soybean.

1437. MULLER, A. S. 1936. Brazil: Some new records of plant diseases in the state of Minas Geraes. Internatl. Bull. Plant Prot. 10:98–99.

Records the occurrence of *Cercospora stevensii* on soybean.

1438. MULLER, A. S. 1941. Survey of diseases of cultivated plants in Venezuela, 1937–1941 [in Spanish]. Soc. Venezolana de Cienc. Natl., Bol. 7:99–113.

Cites the occurrence of: *Bacterium sojae* (= *Pseudomonas glycinea*), a common foliage disease; *Sclerotium rolfsii,* causes wilt in humid sections; *Cercospora glycine,* white spot of leaves on mature plants; and soybean mosaic, which is rare.

1439. MULLER, A. S., and C. CHUPP. 1942. The *Cercospora* of Venezuela [in Spanish]. Soc. Venezolana de Cienc. Natl., Bol. 8:35–59.

Report of collection of *Cercospora sojina* at Maracay, 1937.

1440. MULLER, A. S., and C. CHUPP. 1950. *Cercospora* in Guatemala. Cieba 1:171–178.

Cercospora sojina is collected at Chimaltenago, 1941.

1441. MULLER, A. S. 1950. A preliminary survey of plant diseases in Guatemala. Plant Dis. Reptr. 34:161–164.

Soybeans are affected near maturity by two leaf spots caused by *Cercospora sojina* and *Mycosphaerella pinodes.* In wet seasons *Sclerotium rolfsii* sometimes causes a wilt and *Corticium vagum* causes a pod rot resulting in a great seed loss.

1442. MULVEY, R. H. 1959. Susceptibilities of plants to clover-cyst nematodes, *Heterodera trifolii,* and the period required to complete life cycle. Nematologica 4:132–135.

Inoculated soybeans were not susceptible to *Heterodera trifolii.*

1443. MULVEY, R. H. 1972. Identification of *Heterodera* cysts by terminal and cone top structures. Canad. J. Zool. 50:1277–1292.

This is a taxonomic key based on studies of the terminal and cone top structures of *Heterodera* cysts. Examination of young *H. glycine* cysts revealed a second underbridge in several cysts.

1444. MUMMA, R. O., E. L. LUKEZIC, and M. G. KELLY. 1973. Cercosporin from *Cercospora hayii.* Phytochemistry 12:917–922.

The red pigment cercosporin ($C_{29}H_{26}O_{10}$) has been isolated from cultures of a banana pathogen *Cercospora hayii.* Spectroscopic and chromatographic investigations suggest the structure is 1,12-(2-hydroxypropyl)-2,11-dimethoxy-6,7-methylenedioxyperylene-3,10-quinone. The structures of two related compounds are proposed. Nitrogen sources influencing pigment formation have been determined for *C. hayii* and *C. kikuchii.* Nitrogen source acetamide resulted in maximum production of pigment whereas KNO_2 and diethylamine completely suppressed the pigment formation.

1445. MUNDKUR, B. B. 1938. Fungi of India. Supplement I. India Imper. Counc. Agr. Res. Sci. Monog. 12. 54 pp.

Peronospora manshurica is reported on leaves at Kashmir. Butler and Bisby think this specimen agrees with *P. trifoliorum.*

1446. MUNJAL, R. L. 1960. A commonly occurring leaf spot disease caused by *Myrothecium roridum* Tode. ex. Fr. Indian Phytopath. 13:150–155.

Natural infection with *Myrothecium roridum* has been found at Delhi on soybean and 17 other economic crops. The disease appears during the rainy season as small, circular, tan spots with a broad violet to brown margin surrounded by zones of translucent areas which appear as concentric rings, on which the fructifications of the fungus later appear as dark-green sporodochia surrounded by a rim of white, hairlike mycelia, which become conical or flattened. Generally, the incidence of the disease is low.

1447. MURAKISHI, H. H. 1951. Purple seed stain of soybean. Phytopathology 41:305–318.

Describes symptoms on hypocotyl, stems, leaves, and petioles hitherto unreported in America. Also on seeds and pods like those reported in the Orient. Morphology of *Cercospora kikuchii* is described and illustrated, and cultural characters are described. The fungus did not sporulate on any of a variety of media in culture. It sporulated on living seeds in the laboratory at temperatures of 18–27 C.

1448. MURAS, V. A. 1963. On bacterial wilt of soybeans in the Ukraine [in Ukrainian, English summary]. J. Mikrobiol. (Kiev) 25:42–49.

During 1959–1961 only isolated cases of bacterial wilt (*Pseudomonas solanacearum*) were observed and these in a somewhat attenuated form in soybean plantings. The bacterium, isolated from leaves, stems, pods, and seeds, was identified by morphological, biochemical, cultural, pathogenic, and serological properties. In the Ukraine the bacteria are, apparently, only beginning to adapt on plants and wilting is, therefore, weakly manifested and considerably less frequent than in other areas where the disease occurs.

1449. MURAS, V. A. 1964. Pustular bacteriosis of soybean and the biology of its causative agent [in Ukrainian, English summary]. Mikrobiol. Zhurn. 26:62–66.

Although *Xanthomonas phaseoli* var. *sojense* is fairly widespread in the Ukraine, its incidence is only 1–16%. Affects all above-ground parts of the plant but is found mostly on the leaves. Cultivars Kubanskaya 4958 and VNIIK3 are more resistant than others.

1450. MURAS, V. A. 1964. Bacterial diseases of soybean and their causal agents [in Ukrainian]. Nauchn. Konfer, Molod. Uchen. Biologov. Kiev, Akad. Nauk. SSSR. 1:34–35.

In 1,310 infected samples there were three kinds of bacteriosis: bacterial blight (*Pseudomonas glycinea*), pustular bacteriosis (*Xanthomonas phaseoli* var. *sojense*), and bacterial wilt (*Pseudomonas solanacearum*). The first two are widespread and most harmful in the Ukraine. Soybean seeds and plant remains play an important role in transmission of infection. Seed treatment with the preparations 150 and 152 (analogues of pseudoallicin), and phytobacteriomycin, increased germination by 3–6.4%, and yield by 10–30%, and the incidence of bacteriosis decreased by 1–5%.

1451. MURATA, T. 1925. Soybean mosaic [in Japanese]. J. Plant Prot. (Tokyo) 12:451–452.

1452. MURAVEVA, M. 1965. [Virus diseases of soybean.] Zashch Rast. Vredit. Bolez. 10(10):56.

Yield losses because of virus diseases are 12–100%. Among the most important virus diseases in Primorsk region of U.S.S.R. are soybean mosaic, mottle, rugose, and vein necrosis viruses.

1453. MURAVEVA, M. F. 1968. Virus diseases of soybean [in Russian]. -Uchen. Zap. Khabar. gos. ped. Inst. Ser. Khim.-Biol. 13:156–162.

Viruses widespread on soybean in the Primorsk region include soybean mosaic, bean yellow mosaic, tobacco ring spot, lucerne mosaic, pea mosaic, cowpea mosaic, and bean pod mottle.

1454. MURAVEVA, M. F. 1969. Soybean mosaic [in Russian]. Zashch Rast. Mosk. 14:18–19.

Soybean mosaic virus is widespread in Khabarovsk region of East Siberia. No regional cultivars are resistant. European ones are more susceptible than those from Soviet Far East. General prophylactic measures including control of vectors are recommended.

1455. MURAVEVA, M. F. 1973. Soybean mosaic in the Khabarovsk region [in Russian]. Trudy Dal'nerost N II 5 Kh. 13:156–158.

Soybean mosaic disease reduces soybean yield by 22–94%. Some control measures are indicated.

1456. MURAYAMA, D. 1966. [On the witches' broom disease of sweet potato and leguminous plants in Ryukyu Islands.] Mem. Fac. Agr. Hokkaido Univ. 6:81–103.

Nesophrosyne orientalis readily transmitted witch's broom virus to soybeans.

1457. MURAYAMA, D., and Y. H. HAN. 1971. Occurrence of soybean mosaic virus in Taiwan. Plant Prot. Bull. Taiwan 13:75–86.

A virus widespread in Taiwan causing mosaic symptoms in soybeans was identified. The virus particles observed by electron microscopy had a normal length of 680–750 mμ and width of 12.5–13.0 mμ. They were threadlike and slightly curved. Infectivity of the virus was lost in crude sap heated 10 min. at 60 C or higher. The crude sap was infective at a dilution of 10^{-5}. The virus retained its infectivity in crude sap 4–5 days at 20 C. Infectivity in vacuum-dried leaves remained for 7 days at room temperature. A number of plant species were inoculated mechanically in the greenhouse to test their susceptibility to the virus. Besides soybean, some cultivars of *Vigna sinensis, Phaseolus angularis,* and *P. vulgaris* were found susceptible, with evident mosaic symptoms. Local lesions were formed on inoculated leaves of *Chenopodium album, C. amaranticolor,* and some cultivars of *Phaseolus vulgaris.* Seed collected from infected plants showed mottling on seed coat and produced seedlings that were systemically infected. *Myzus persicae* was found to transmit the virus. The virus reacted positively with antiserum against soybean mosaic virus isolate SV-15 both in interface ring precipitin test and agar gel double diffusion test. Data obtained from the present studies indicated that the virus under study is a strain of soybean mosaic virus.

1458. MURAYAMA, D., M. KOJIMA, and T. TAMADA. 1973. Purification and serology of two aphid-borne circulative viruses. 2nd Internatl. Cong. Plant Path. Abstrs. 0092.

Potato leaf-roll (PLRV) and soybean dwarf (SDV) viruses of potato leaf-roll virus group were transmitted circulatively by aphid vectors and had low concentration within plant hosts. These viruses were purified by the

following procedures: maceration of plant materials adding 0.5 M phosphate buffer, clarification with a mixture of chloroform and *n*-butanol, addition of 8% PEG (#6,000) to clarify fluorocarbon, two cycles of differential centrifugation followed by sucrose density-gradient centrifugation. They are small isometric viruses with 25 nm diameter and have similar sedimentation rates in sucrose density-gradient columns. UV absorption spectra of both viruses were quite similar. Nucleic acid content seemed high. In ring precipitin tests, antisera against PLRV and SDV had titers of 1/4096 and 1/2048, respectively. In micro-agar-gel-diffusion tests, a visible line was recognized between each reactant. In SDV, the antiserum neutralized the infectivity. No serological relationships were found between PLRV and SDV.

1459. MUSIL, M., J. MATISOVA, and B. A. KVICALA. 1966. [Some notes on lucerne mosaic virus on legume forage crops in Czechoslovakia.] Ochr. Rost. (n.s.) 2:125–134.

Lucerne mosaic virus was isolated from soybean. In crude sap dilution the end point was 10^{-3}, longevity in vitro was 24 hr. and thermal inactivation point was 55–60 C.

1460. MUSIL, M. 1966. [On the occurrence of white clover virus in Slovakia.] Ochr. Rost. (n.s.) 2:135–143.

Symptoms of white clover mosaic virus on soybean in Czechoslovakia are described.

1461. MUSIL, M. 1966. On the incidence of red clover mottle virus in Slovakia [in Russian, German summary]. Biologia Brastist. 21:613–620.

Red clover mottle virus in Russia was transmitted by sap inoculation to soybean.

1462. MUSIL, M., and O. LESKOVA. 1969. [Some properties of pea enation mosaic virus isolated from field pea and broad bean plants in Bohemia.] Biologia Pl. 11: 319–323.

The virus was transmitted mechanically or by *Acyrthosiphon pisum* to soybean. The strain differs from that already reported from Czechoslovakia.

1463. MYHRE, D. L., H. N. PITRE, M. HARDIASAN, and J. D. HESKETH. 1973. Effect of bean pod mottle virus on yield components and morphology of soybeans in relation to soil water regimes: A preliminary study. Plant Dis. Reptr. 57:1050–1054.

The yield components and morphology of Bragg soybean naturally infected with bean pod mottle virus (BPMV) prone to bloom and grown under different soil water regimes were compared with those of healthy plants growing adjacent to a diseased plant under the same conditions in field plots. Healthy plants yielded higher than diseased plants, irrespective of the soil water regimes. BPMV infection reduced yield by 29%. BPMV infection was more detrimental than the imposed soil water stress during the growing season. A soil water stress coupled with BPMV infection further decreased yield. Lower yields caused by infection were reflected in a reduction in total dry matter and total number of fruiting sites and pods per plant. Plant height, number of pods per fruiting site, number of seeds/pod, and mean weight of seeds were not affected by BPMV infection.

1464. NACION, C. C. 1924. Study of Rhizoctonia blight of beans. Philipp. Agr. 12:315–321.

Inoculation of soybean seedlings with *Rhizoctonia solani* isolated from lima bean resulted in typical Rhizoctonia blight symptoms.

1465. NAGATA, T. 1962. Report to the government of Yugoslavia on improvement of soybean cultivation. FAO Expanded Tech. Asst. Prog., FAO Rpt. 1465. 22 pp.

In 1961 there was little damage from diseases, unlike the previous wet years when downy mildew (*Peronospora manshurica*) and purple spot (*Cercospora kikuchii*) were prevalent. Suggested control for downy mildew was bordeaux mixture and other chemicals such as organic Hg compounds.

1466. NAGORNY, P. I., and E. M. ERISTAVI. 1929. A brief survey of plant diseases in Abkhasia in 1928 [in Russian]. Agr. Expt. Sta. Abkhasia Pub. 38, pp. 1–38.

Phyllosticta sojaecola on soybean leaves formed rounded or irregular, dark-gray or brown spots with a narrow black margin.

1467. NAKANO, K. 1919. Leaf scorch of soybean [in Japanese]. J. Plant Prot. (Tokyo) 6:217–221.

An account of leaf scorch symptoms and the causal organism which is named *Pseudomonas glycines* n.sp. (= *P. glycinea*).

1468. NAKATA, K., and K. TAKIMOTO. 1934. A list of crop diseases in Korea [in Japanese]. Agr. Expt. Sta. Govt. Central Chosen Res. Rpt. 15, pp. 1–146.

Includes the following diseases and pathogens: *Bacterium* sp. causing leaf spot, *Mycosphaerella sojae* downy mildew, *Phyllosticta sojaecola, Septoria glycines, Cercospora* sp., *Hypochnus centrifugus, Cercosporina* (= *Cercospora*) *kikuchii, Colletotrichum glycines* (= *C. dematium* f. *truncata*), and *Gloeosporium* sp.

1469. NAKATA, K., and H. ASUYANA. 1938. Survey of the principal diseases of crops in Manchuria [in Japanese]. Bur. Indus. Rpt. 32, p. 166.

The soybean-cyst nematode was found in Manchuria. Resistance to the nematode in cultivar Kung No. 557 had occurred, but other cultivars had no resistance.

1470. NAKATA, K. 1940. Report of diseases of agricul-

tural and horticultural crops in North China and Mongolia [in Japanese]. Agr. Expt. Sta. North China Surv. Rpt. 1, pp. 1–92.

Includes the following diseases on soybean: Downy mildew, bacterial pustule, *Phyllosticta* sp., and mosaic.

1471. NAKATA, K. 1941. A report on a disease survey of farm and horticultural crops in North China [in Japanese]. North China Agr. Expt. Sta. Bull. 1. 72 pp.

1472. NAKATA, K., and H. ASYUAMA. 1941. Report on diseases of main agricultural crops in Manchuria [in Japanese]. Bureau Indus. Manchuria Rpt. 32, pp. 1–166.

Includes the following diseases and pathogens on soybean: Bacterial pustule, downy mildew, chlorosis, mosaic, *Phyllosticta sojaecola, Cercospora sojina, Cercosporina* (= *Cercospora*) *kikuchii,* and wilt of unknown cause.

1473. NANCE, N. W. 1948. Some unusual or outstanding plant disease developments in the United States in 1947. Plant Dis. Reptr. Suppl. 177:143–169.

Records the occurrence of *Diaporthe phaseolorum* var. *sojae* in Ohio, and of *Phyllosticta glycineum* (= *P. sojaecola*) in Missouri.

1474. NANCE, N. W. 1950. Some new or noteworthy plant disease records and outstanding developments in the United States in 1949. Plant Dis. Reptr. Suppl. 194: 364–380.

Cephalosporium gregatum and *Diaporthe phaseolorum* var. *caulivora* caused serious losses.

1475. NAOUMOFF, N. 1914. Materiaux pour la flore mycologique de la Russie, fungi Ussurienses I. Bull. Soc. Myc. France 30:64–83.

Contains a technical description of *Peronospora trifoliorum* var. *manshurica* n.var. (= *P. manshurica*).

1476. NARASIMHAN, M. J. 1934. Report of work done in the mycological section during 1932–1933. Agr. Dept. Mysore, Admin. Rpt. 1932–1933, pp. 53–56.

Rhizoctonia sp. occurred on soybean.

1477. NARAYANASAMY, P., and P. DURAIRAJ. 1971. A new blight disease of soybeans. Madras Agr. J. 58:711–712.

Found in India, *Drechslera glycini* has brown septate hyphae; erect conidiophores septate, simple, or branched, brown and geniculated; conidia borne acrogenously, straight or slightly curved, brown, with 2–11 septa, basal hilum 31–93 × 13–19 μ. Leaf spots are brown, circular or angular at initial stage. As they enlarge, the center becomes grayish with dark brown peripheral zone. Lesions also formed on cotyledons and young leaves.

1478. NARIANI, T. K. 1960. Yellow mosaic of mung (*Phaseolus aureus* L.). Indian Phytopath. 13:24–29.

Soybean was susceptible when inoculated by white flies (*Bremisia tabaci*) with symptoms appearing after 18 or 19 days. The young leaves show faint chlorotic areas which turn yellow later. The yellow areas are more predominant in the new growth and increase in size to form large yellow patches.

1479. NARIANI, T. K., and K. V. PINGALEY. 1960. A mosaic disease of soybean (*Glycine max* (L.) Merr.). Indian Phytopath. 13:130–136.

Mosaic virus was found during a routine survey near New Delhi, India, in September 1956. Twenty-eight cultivars growing in the field were infected, infection varying 7–30% depending on the cultivar. Symptoms are described. Four species of aphids were found capable of transmitting the virus. Virus is seed-transmitted.

1480. NATTI, J. J. 1959. Systemic infection of bean by tobacco necrosis virus in New York. Phytopathology 49: 228. (Abstr.)

In greenhouse tests Manchu cultivar of soybean became systemically infected upon inoculation of primary leaves.

1481. NATTRASS, R. M. 1952. Annual report of the senior plant pathologist, 1950. Kenya Dept. Agr. Ann. Rept. 1950, vol. 2, pp. 72–77.

Synchytrium dolichi on *Glycine javanica,* determined from a specimen received from Kenya.

1482. NATRASS, R. M. 1961. Host lists of Kenya fungi and bacteria. Commonw. Mycol. Papers 81. 46 pp.

Records the occurrence on soybean of: *Alternaria tenuissima* Wilts. and *Synchytrium dolichi,* and on *Glycine javanica* of *Ascochyta sojaecola, Cercosporella* sp. and *S. dolichi.*

1483. NEELY, R. D. 1957. A study of Fusarium root rot and wilt of soybeans. Diss. Abstr. 17:2132–2133.

In summer 1953, a new disease of soybean caused by *Fusarium orthoceras* was reported from north central Missouri on heavy river-bottom soil. The symptoms were slight chlorosis, rapid wilting and subsequent drying of leaves which remain attached to the stem, necrosis of roots, characteristic discoloration of the vascular system of roots and stem. Certain strains of soybean were tolerant or genetically resistant. Other crops were not affected. The fungus tolerated a wide pH range (2–11) and temperatures from 10–40 C. A flooding inoculation technique was used, this being most comparable to natural mode of infection. Variation in pathogenicity of the fungus was noted. Wilt production is ascribed to a nonvolatile substance toxic to soybean plants.

1484. NELEN, E. S. 1962. [Fungi-causal agents of diseases of agricultural crops in the Amur region.] Soobscheh Fil. Sibiv. Otdel. Akad. Nauk. SSSR 16:87–90.

Reports *Septoria sojina* on soybean, new to Amur region, U.S.S.R.

1485. NELEN, E. S., and S. A. ZHUKOVSKAYA. 1967. [Verticillium of soybean.] Zashch Rast. Mosk. 12(8):45–46.

Severe infection by *Verticillium foexii* (*Gliocladium roseum*) in Soviet Far East is favored by poor, heavy soils and low spring temperatures. Seed treatment with thiram or granosan is recommended. Soybean should not be grown two years in succession.

1486. NELEN, E. S., and S. A. ZHUKOVSKAYA. 1968. [Anthracnose of soybean.] Zashch Rast. Mosk. 13: 45.

This dangerous disease new to U.S.S.R., caused by *Colletotrichum glycines* (= *C. dematium* f. *truncata*), was observed on young plants of many cultivars in Soviet Far East in 1965. Early and severely infected plants lagged in growth, developing few or no branches and only a few roots, and soon died. Regular rotation and seed treatment with granosan or thiram with heat treatment at 50 C for 6 hr. are among the controls recommended.

1487. NELEN, E. S. 1968. [Fungus diseases of agricultural plants new for Soviet Union.] Mikol. i. Fitopatol. 2:128–133.

Colletotrichum glycines (= *C. dematium* f. *truncata*) and *Verticillium foexii* were recorded on soybean.

1488. NEMLIENKO, E. F., and T. O. KULIK. 1958. Insects as carriers of cotyledon bacteriosis in soybeans [in Russian, English and German summaries]. Vestnik Sel'skokhoz. Nauki 3:129–131.

In Moscow in 1955–1957 *Carpocoris fusispinus* were caged on young soybean plants in small parchment bags. Plants exposed to insects in mid-August were injured and showed very high infection of bacteriosis (? *Pseudomonas glycinea*) (up to 95.1%), whereas those exposed in first half of September were not injured and bacteriosis incidence was 3%. Dusting with hexachlorane after bean formation reduced the insect population to 50% and bacterial infection was considerably less.

1489. NEMLIENKO, E. F., and T. O. KULIK. 1960. Cotyledon bacteriosis of soybean [in Russian]. Ukr. SSR Akad. Sil's'kohos. Nauky, Visnyk Sil's'kohos. Nauky 1960 (7):96–98.

Symptoms developed only on the cotyledons of seeds infected in the field during formation and ripening, so annual variation in infection is related to insect population. *Carpocoris fusispinus* was demonstrated as playing a major role in transmission of *Xanthomonas phaseoli* var. *sojense*. Plant nutrition and soil have no significant role in transmission of the pathogen, which is not seed transmissible to the new crop, nor is incidence of infection in the crop dependent on that of the seed material. Seed treatment with thiram reduced infection 3–8-fold and in some years completely eliminated the disease.

1490. NENE, Y. L., V. K. AGARWAL, and S. S. L. SRIVASTAVA. 1969. Influence of fungicidal seed treatment on the emergence and nodulation of soybean. Pesticides (April):26–27.

Under the Tarai conditions, seed treatment with captan or thiram is essential to ensure proper plant population and that these fungicides do not adversely affect root nodulation.

1491. NENE, Y. L., and S. S. L. SRIVASTAVA. 1971. Outbreaks and new records. Plant Prot. Bull. FAO 19: 66–67.

Purple stain of soybean caused by *Cercospora kikuchii* and pod blight caused by *Colletotrichum dematium* f. *truncata* were reported for the first time from India.

1492. NENE, Y. L., S. S. L. SRIVASTAVA, A. K. SARBHOY, M. N. KHARE, and H. C. SHARMA. 1971. Soybean seed rot and damping off (*Aspergillus, Colletotrichum, Fusarium, Phytophthora* and *Pythium* sp.) Amer. Phytopath. Soc. Fungicide and Nematicide Tests, Results of 1970. 26.144.

Poor germination in soybeans is a problem due to seed-rotting fungi. Therefore a national coordinated fungicidal seed treatment trial was laid out in kharif (July–Oct.) season of 1969–1970 at three centers. The seeds were treated with thiram (75%), captan (75%), PCNB 75%, and a mixture (thiram + captan + PCNB in a 1:1:1 ratio) at the rate of 4.5 g/kg of seed and with aureofungin at the rate of 25 ppm. Thiram proved to be best among all treatments in improving the emergence. The reduction in nodule count in the thiram treatment was not significant as compared to the check. The treatments had no significant effect on yield at two centers whereas significant yield increase, at least at one center, indicated that it is worthwhile to seed-treat soybeans.

1493. NENE, Y. L., P. N. THAPLIYAL, S. S. L. SRIVASTAVA, A. K. SARBHOY, and M. N. KHARE. 1973. Soybean seed and seedling rot (*Aspergillus, Cercospora, Colletotrichum, Fusarium, Rhizoctonia, Sclerotium*). Amer. Phytopath. Soc. Fungicide and Nematicide Tests, Results of 1972. 28:151–152.

A coordinated fungicidal seed treatment was conducted during the growing season (July–Oct.) of 1970–1971 at three centers. Seeds were treated with thiram, captan, PCNB, benomyl, a fungicide mixture (thiram + captan + PCNB in a 1:1:1 ratio) and aureofungin at the rate of 4.5 g/kg of seed excepting benomyl and aureofungin which were used at the rate of 3 g/kg and of 25 ppm, respectively. Thiram proved to be best among all treatments in improving the emergence at all three locations and at the same time showed no significant reduction of nodulation. Data gathered through these coordinated seed-treatment trials have clearly established the beneficial effects of soybean seed treatment with thiram at the rate of 0.45%.

1494. NENE, Y. L. 1973. Viral diseases of some warm weather pulse crops in India. Plant Dis. Reptr. 57:462–467.

Soybean cultivars Lee and Bragg are highly susceptible to mungbean yellow mosaic virus, transmitted only by white fly *Bemisia tabaci.* The virus is widely prevalent in India.

1495. NGUYEN, T. H., S. B. MATHUR, and P. NEERGAARD. 1973. Seedborne species of *Myrothecium* and their pathogenic potential. Trans. Brit. Mycol. Soc. 61:347–354.

Myrothecium verrucaria from soybean seed is pathogenic to plants.

1496. NIBLETT, C. L., L. B. JOHNSON, and R. F. LEE. 1974. Aspartate transcarbamylase activity in etiolated cowpea and soybean infected with cowpea mosaic virus or tobacco ring spot virus. Physiol. Plant Path. 4: 63–71.

Aspartate transcarbamylase activity was measured in buffer extracts of healthy and virus-infected etiolated hypocotyls of cowpea and soybean. Enzyme activity was measured by incorporation of [^{14}C]aspartic acid into ureidosuccinate. Products and reactants were separated by dowex-50 chromatography and identified by thin layer chromatography. In cowpea hypocotyls infected with cowpea mosaic virus, up to 5.7-, 2.8- and 2.4-fold increases were observed in aspartate transcarbamylase activity, RNA and soluble protein, respectively, and cowpea mosaic virus concentration reached as high as 260 μg/g. In soybean hypocotyls infected with cowpea mosaic virus, aspartate transcarbamylase activity increased only 1.2-fold and cowpea mosaic virus concentration was less than 20 μg/g. In soybean hypocotyls infected with tobacco ring spot virus, aspartate transcarbamylase activity increased to 1.6-fold, with significant virus synthesis (130–220 μg/g). Aspartate transcarbamylase from healthy cowpea hypocotyls and those infected with cowpea mosaic virus was similarly inhibited by uridine monophosphate. Treating enzymes with uridine monophosphate or mild heat gave no indication that increased aspartate transcarbamylase activity in infected tissues was due to release of preexisting enzyme from a feedback-inhibited state.

1497. NICHOLSON, J. F., and J. B. SINCLAIR. 1971. *Pseudomonas glycinea* inhibits germination of soybean seed. Phytopathology 61:904. (Abstr.)

A new role of *Pseudomonas glycinea* in soybean pathology was studied. Two isolates of an internally seedborne bacterium in soybean inhibited the germination of Lee 68 and Amsoy soybean seed. In culture, one isolate had a smooth surface and margin whereas the other had a rough surface and margin. Both isolates were identified as *P. glycinea* through a series of standard biochemical tests compared to stock cultures of *P. tabaci* and *P. glycinea.* Our isolates and the stock isolate of *P. glycinea* did not grow on Kado's selective medium D4 for pseudomonads. When suspensions of three *P. glycinea* isolates were infiltrated by vacuum into sterilized Amsoy seed, germination was significantly inhibited by the rough-margined and stock culture isolates to 38 and 68%, respectively, whereas the smooth-margined isolate had normal germination (84%) compared with the control (88%). The bacterium was isolated from 17 seed lots of Lee 68 soybean collected from five states. Occurrence in individual seed lots was as high as 54% and as low as 3%.

1498. NICHOLSON, J. F., and J. B. SINCLAIR. 1971. *Thielavia basicola* and *Pestalotia* sp. internally seedborne in soybean. Plant Dis. Reptr. 55:911–912.

The internally borne fungi of 17 seed lots of Lee 68 soybeans harvested in five states were determined in vitro. Fungi isolated represented the following genera: *Alternaria, Aspergillus, Cercospora, Chaetomium, Fusarium, Penicillium, Pestalotia, Rhizopus, Sclerotinia,* and *Thielavia* (*basicola*). Occurrence was influenced more by growing area than by different dates of planting, harvesting dates, or whether seed was hand- or machine-harvested. *Pestalotia* and *T. basicola* have not been previously reported from the United States as being internally seedborne in soybeans. *T. basicola* was reisolated from soybean stems above the point of wound-inoculation.

1499. NICHOLSON, J. F., and J. B. SINCLAIR. 1971. Amsoy soybean seed germination inhibited by *Pseudomonas glycinea.* Phytopathology 61:1390–1393.

Pseudomonas glycinea was shown to inhibit germination of soybean seed and thus affect seed quality. Two isolates were recovered from infected seed and were distinguished in vitro, in that one had a smooth surface and margin, the other a rough surface and margin. Both isolates were identified as *P. glycinea* by their identical reactions to standard biochemical tests as compared with the reaction of a known culture of *P. glycinea.* The three isolates did not grow on Kado's selective medium D4 for pseudomonads. When suspensions of our two isolates were infiltrated by vacuum into sterilized Amsoy seed, germination was significantly inhibited (death of seed) to 45% by the rough-margined isolates, and was significantly delayed to 84% by the smooth-margined isolates, as compared to 90% germination of the control. The known culture of *P. glycinea* inhibited germination 68%. The bacterium was isolated from 17 seed lots of Lee 68 collected from five states. Recovery in vitro of *P. glycinea* isolates ranged from 4 to 64% among the individual lots. The incidence of *P. glycinea* was correlated with the inhibition of germination both in naturally infested and artificially inoculated seed.

1500. NICHOLSON, J. F., O. D. DHINGRA, and J. B. SINCLAIR. 1972. Internal seedborne nature of *Sclerotinia sclerotiorum* and *Phomopsis* sp. and their effects on soybean seed quality. Phytopathology 62:1261–1263. [Corrected title: *Sclerotinia sclerotiorum* should read as *Diaporthe phaseolorum* var. *sojae*.]

Diaporthe phaseolorum var. *sojae* (*Dps*) (*Phomopsis* sp.) is internally seedborne in soybean and may inhibit seed germination in vitro and field emergence. *Dps* was internally seedborne in 30 of 39 lots of Lee 68 seed harvested from six states in 1969 and 1970, in eight lots of 1971 Cutler seed from Kentucky, and in the lot of Beeson and 17 lots of Amsoy 1971 seed from Illinois. When recovery was more than 25%, in vitro germination and field emergence were reduced. Recovery of *Dps* from Lee 68 seed was reduced when stored at room temperature (22 ± 3 C) after 6–24 mo. when compared to samples of the same seed lots stored for 17 mo. at 3 ± 1 C. Recovery from Cutler seed increased 26% between normal and late harvest periods 30 days apart, but harvest method (machine or hand) appeared to have no effect on percentage occurrence of the fungus. *Dps* was first isolated from seed and pods of field-grown plants at 16 weeks after planting. *Phomopsis* sp. was internally borne in the following seed lots: 12 of 20 Lee 68 lots harvested in 1970 from five states; eight lots of 1971 Cutler seed from Kentucky; one lot of 1971 Beeson seed; and 17 lots of 1971 Amsoy seed from Illinois. *Phomopsis* sp. was recovered from less than 25% from any single lot assayed, except for two lots. A reduction in in vitro germination or field emergence was not detected.

1501. NICHOLSON, J. F., J. B. SINCLAIR, and P. N. THAPLIYAL. 1973. The effect of rate of planting on incidence of brown stem rot in soybean. Plant Dis. Reptr. 57:269–271.

The incidence of brown stem rot of soybeans, caused by *Cephalosporium gregatum,* increased as the space between plants within row was increased during three successive growing seasons in field plots with a previous cropping history of 2 years or less in soybeans. The percentage of plants showing brown stem rot at 6- and 12-in. spacing was significantly higher than that at 1-, 2-, and 4-in. Plots with a cropping sequence of 5 or more years of continuous soybeans showed no significant differences between planting date and incidence of brown stem rot. Spacing and crop history could be important factors in evaluating cultivars or breeding lines for resistance to *C. gregatum* or in conducting brown stem rot disease surveys.

1502. NICHOLSON, J. F., J. B. SINCLAIR, and L. K. JOSHI. 1973. Seedborne *Pseudomonas glycinea* and fungi affect soybean seed quality in India. Plant Dis. Reptr. 57:531–533.

Pseudomonas glycinea, causal agent of bacterial blight of soybean, was shown to be seedborne in 27 Bragg soybean seed lots grown in Madhya Pradesh, India. This is the first report of *P. glycinea* occurring in India. The bacterium significantly reduced field emergence of naturally infected and inoculated Bragg seeds. Fungi associated with the same seed lots significantly reduced laboratory germination to the extent that effects of *P. glycinea* on germination could not be measured. *Fusarium* spp., *Macrophomina phaseolina, Sclerotinia sclerotiorum, Phoma* sp., and *Sclerotium rolfsii* were also isolated from seeds.

1503. NICHOLSON, J. F., and J. B. SINCLAIR. 1973. Effect of planting date, storage conditions and seedborne fungi on soybean seed quality. Plant Dis. Reptr. 57:770–774.

Seed lots were collected in October from five soybean cultivars planted during the rainy season 1971 at Jabalpur, India, on June 1, 16, July 1, 16, 31, August 14, and September 2. The lots were separated by cultivar and planting date and stored at room temperature (15–45 C) or in a refrigerator (1–5 C). The number of days to maturity and yield were reduced approximately 50% from the first to last planting date. The number of purple- and brown-stained seeds, seeds with damaged seed coats and 100-seed weights of all cultivars decreased from first to last planting date. Seeds from the first three planting dates stored in a refrigerator had greater percentage of internally borne fungi and a lower percentage germination than those stored at room temperature. Fungi most frequently isolated were: *Macrophomina phaseolina, Sclerotinia sclerotiorum, Colletotrichum truncatum* (= *C. dematium* f. *truncata*), *Sclerotium rolfsii, Cercospora* spp., and *Fusarium* spp. Seeds from the first three planting dates had significantly more seedlings with *C. truncatum* lesions than did those from the remaining four planting dates. Percentage emergence of seeds for all cultivars from both storage conditions in greenhouse and field plots was lower for first three plantings than for the remaining four.

1504. NICHOLSON, J. F., J. B. SINCLAIR, and J. C. WHITE. 1973. Survival and entry of *Pseudomonas glycinea* into soybean seed. Phytopath. Z. 78:357–364.

Two colony types of *Pseudomonas glycinea* were recovered from 17 seed lots of Lee 68 soybean seed after 18 mo. storage at 22 ± 2 C and 13 lots after 24 mo. at 3 ± 1 C and 60% RH. Average recovery was 10% after 19 mo. and 8% after 24 mo. Average field emergence of seed stored 24 mo. was 66%. *P. glycinea* was isolated from all above-ground parts of field-grown soybean plants in Illinois with or without the appearance of gross symptoms of bacterial blight. The bacterium was isolated from seed of field-grown Lee 68 plants throughout the growing season beginning 1 week after flowering, but not in Amsoy. The bacterium was not isolated from seed of Amsoy plants grown and inoculated in a growth chamber, but was isolated after the seed was mixed with

contaminated chaff from diseased plant parts. Seed artificially infested by vacuum infiltration with suspension of the bacterium reduced field emergence and, in one of two isolates, significantly reduced yields.

1505. NICHOLSON, J. F., O. D. DHINGRA, and J. B. SINCLAIR. 1973. Soil temperatures and inoculation techniques affect emergence and reisolation of *Sclerotinia sclerotiorum* from soybean. Mycopath. Mycol. Appl. 50:179–182. [Corrected title: *S. sclerotiorum* should be read as *Diaporthe phaseolorum* var. *sojae*.]

Emergence of Amsoy soybean seed inoculated with *Diaporthe phaseolorum* var. *sojae* was significantly reduced below noninoculated seed at soil temperatures of 25, 30, and 35 C, but not at 20 C. The fungus was readily reisolated from wound-inoculated stems of seedlings and nearly mature plants above the point of inoculation and below to the crown area, but not from roots. The fungus was recovered from stems but not roots of 15-day-old seedlings grown in sterile soil before infestation of the soil surface with a suspension of mycelium and sclerotia and assayed at 15 days after soil infestation. When compared to healthy seeds, seed infected with *D. phaseolorum* var. *sojae* were characterized by appearing flattened.

1506. NICHOLSON, J. F. 1973. The effect of internally seed-borne microorganisms on soybean seed quality. Ph.D. thesis, Univ. Illinois. 41 pp.

Two phytopathogens, internally borne in soybean seed from the United States and India, were shown for the first time to significantly reduce germination and field emergence of soybean seed and thus affect seed quality. *Pseudomonas glycinea* was isolated from each of 17 lots of Lee 68 soybean seed from the United States and 27 lots of Bragg from India. Two isolates were recovered from infected seed and were distinguished in vitro in that one had a smooth surface and margin, the other a rough surface and margin. The rough-margined isolates and a similar isolate from B. W. Kennedy significantly reduced germination of inoculated seeds below that of noninoculated controls. *Colletotrichum truncatum* reduced the preemergence of seedlings from inoculated seeds in India by 25% and postemergence by 80%. Cotyledon-inoculation studies with this fungus showed that time of infection as well as point of infection was important in determining the extent of seed and seedling kill. The effect of seven dates of planting during the monsoon season of India on the occurrence of internally seed-borne fungi in five cultivars was studied. The presence of fungi decreased sharply for soybean planting dates of July 15 and later during the 1971 growing season. Germination and emergence significantly increased with later planting.

1507. NICHOLSON, J. F., and J. B. SINCLAIR. 1974. Soybean (*Glycine max*) seed decay, *Pseudomonas glycinea*. Amer. Phytopath. Soc. Fungicide and Nematicide Tests, Results of 1973. 29:146.

A lot of Lee soybean seed was used that after surface-sterilization showed 60% of the seed contained *Pseudomonas glycinea* when bioassayed on Difco lima bean agar. Bioassay of nonsurface-sterilized seed from the same lot showed that all seeds were contaminated with the bacterium. *P. glycinea* caused preemergence kill both under laboratory conditions and in the field. Two bactericides, hexachlorophene and isobac 20, were used as seed treatments at 12.5, 25, 50, 100, and 200 ppm. The compounds were mixed with dichloromethane and the seeds soaked in the respective concentrations for 13 hr. A nontreated and dichloromethane-soaked group served as controls. The seeds were air-dried, then planted in a completely randomized field plot at the University of Illinois South Farm. There were four replicates with 100 seeds per replicate. Field emergence was recorded at 14 days after planting. Hexachlorophene at 25 and 50 ppm and isobac 20 at 12.5 ppm significantly increased germination above the controls.

1508. NIEMANN, E., G. SCHARIF, and A. MIRKAMALI. 1967. Field susceptibility of some cultivated plants to *Sclerotium rolfsii* Sacc. [in German, English summary]. Entom. Phytopath. Appl. 26:22–26.

Soybeans showed slight infection by *Sclerotium rolfsii* in the field.

1509. NIKOLIC, V. 1951. A new soybean disease in our country. Preliminary note [in Serbian, English summary]. Zashtita Bilja 8:39–40.

Peronospora manshurica was found at Bogatic in 1951, the first report from Yugoslavia. Leaf infection and seed encrustation were noted.

1510. NISHIZAWA, T., and S. KINOSHITA. 1954. On the varietal resistance of soybeans to the bacterial pustule disease [in Japanese]. Kyushu Agr. Res. 14:203–206.

Inoculations of nine cultivars with *Xanthomonas phaseoli sojense* by needle puncture methods and by different spraying methods showed a variation in susceptibility of some individual cultivars as to which method was used.

1511. NISHIZAWA, T., S. KINOSHITA, and H. YOSHII. 1955. On the soybean blast and its causal fungus *Septogloeum sojae* n.sp. [in Japanese, English summary]. Ann. Phytopath. Soc. Japan 20:11–15.

Gives a Latin description of the fungus collected in Kyushu, Japan, 4 August 1954.

1512. NISIKATA, T. 1938. Studies on the brown mottling of soybean. Agr. Expt. Sta. S. Manchuria Railway Co. Bull. 24, pp. 83–94.

In comparison with healthy seed, mottled seed con-

tained less crude fat, more crude protein, and less sugars, but amount of reducing sugar was increased in the endosperm of mottled seed. Among the inorganic matter in seed coat, Mn_3O_4 and Fe_2O_3 and Al_2O_3 were increased significantly by mottling.

1513. NISIKATA, T. 1938. Studies on brown mottling of soybean. II. Several considerations on the factors producing the brown mottling. Agr. Expt. Sta. S. Manchuria Railway Co. Bull. 25, pp. 43–59.

Moisture content of soil is considered an important factor in producing mottling. The application of Fe and Mn into soil significantly increased the mottled seed.

1514. NOBLE, R. J. 1931. New South Wales: Plant diseases. Internatl. Bull. Plant Prot. 5:202–205.

Cites one record of *Bacterium* (=*Xanthomonas*) *phaseoli sojense* and one record of *B. glycineum* (= *Pseudomonas glycinea*).

1515. NOBLE, R. J., H. J. HYNES, F. C. MCCLEERY, and W. A. BIRMINGHAM. 1935. Plant diseases recorded in New South Wales. Dept. Agr. New South Wales Sci. Bull. 46.

Lists *Alternaria* sp. and *Phyllosticta* sp. causing leaf spots, *Bacterium* sp. causing blight, *Bacterium phaseoli sojense, Fusarium* sp. causing root rot, *Heterodera marioni,* and *Sclerotium rolfsii* on soybeans.

1516. NOBLE, R. J., H. J. HYNES, F. C. MCCLEERY, and W. A. BIRMINGHAM. 1937. Plant diseases recorded in New South Wales. Supplement 1. New South Wales Dept. Agr. 7 pp.

Lists *Bacterium glycineum* (= *Pseudomonas glycinea*) on soybeans.

1517. NOBLE, R. J. 1937. Australia: Notes on plant diseases recorded in New South Wales for the year ending 30th June, 1937. Internatl. Bull. Plant Prot. 11:246–247.

A witch's broom-like condition occurred on soybeans.

1518. NOJIMA, T. 1926. On a disease of soybean pods due to the parasitism of a Fusarium fungus [in Japanese]. J. Plant Prot. (Tokyo) 13:138–147.

A species of *Fusarium* with white to light-pinkish mycelium produced numerous salmon-pink spots on the pods of soybean. Infection occurred chiefly through wounds. The fungus was unable to attack roots, leaves, and stems.

1519. NOLL, W. 1939. Studies on foot rot and wilt diseases in Leguminosae [in German]. Zeit. Pflanzkh. 49: 385–431.

Three strains of *Ascochyta pinodella* isolated from peas, broad beans, and soybeans were pathogenic to the same three hosts in Germany. From 29 samples of soybean plants killed by wilt and foot rot, *Fusarium oxysporum* was isolated 27 times. Other fungi isolated were *Rhizoctonia solani, Fusarium* spp., and *Ascochyta pinodella.*

1520. NORMAN, A. G. 1963. The soybean. Academic Press, New York. 23 pp.

The author discusses several diseases of soybean.

1521. NORONOHA, A., M. VICENTE, A. A. FRENHANI, and R. A. S. KUHL. 1972. Effect of temperature on the appearance of the necrosis on soybean cotyledons [in Portuguese, English summary]. Biologico 38: 384–387.

Seedlings from seeds kept at 40 C for different periods showed necrosis on the cotyledons, but no causal organism could be isolated. This implied that temperature was either directly responsible for necrosis or favored the development of some pathogen hitherto unisolated.

1522. NORRIS, M. G., W. O. MILLER, W. G. WRIGHT, J. A. COMBS, and J. P. MAYBRY. 1974. Fumazone 86E nematicide and a preplant incorporated herbicide as a tank mix for nematode and cocklebur control in soybeans. Down to Earth 29(4):3–5.

A preplant incorporated tank mix application of fumazone 86E nematicide and treflan herbicide was an effective method for nematode control in soybeans. However, it did require 4–6 qt./acre followed by immediate incorporation by double discing.

1523. NORTON, D. C., L. R. FREDERICK, P. E. PONCHILLIA, and J. W. NYHAN. 1971. Correlations of nematodes and soil properties in soybean fields. J. Nematol. 3:154–163.

Soil samples from 40 soybean fields were collected in 1967 and 1968 and analyzed for nematodes and soil properties. Correlations of total nematodes, nonstylet nematodes, Dorylaimoidea (excluding *Xiphinema americanum*), *X. americanum, Helicotylenchus pseudorobustus, Tylenchus* spp., *Aphelenchus avenae,* and other groupings of nematodes were made with pH; percentage sand, silt, and clay; percentage organic matter; cation exchange capacity; saturation percentage; and percentage saturation. Organic matter, pH, and cation exchange capacity were most consistently highly correlated with the soil factors. Correlations of nematodes were with more soil factors and were stronger in a wet than in a dry year. Highest numbers of nematodes were usually found in the lighter soils, except in the loamy sand where moisture probably was limiting. In general, soil moisture levels below 20% saturation were probably limiting for most nematodes studied, except for the dorylaims which survived in large numbers in soils with less than 20% saturation.

1524. NORTON, D. C., and N. BURNS. 1971. Colonization and sex ratios of *Pratylenchus alleni* in soybean roots under two soil moisture regimes. J. Nematol. 3: 373–377.

Population size and sex ratios of *Pratylenchus alleni* in soybeans were studied under two different moisture regimes in Hagener loamy fine sand. Soil moisture was maintained from field capacity to 50% below field capacity in the dry regime and from field capacity to 25% above field capacity in the wet regime. The initial peak of colonization of soybeans by *P. alleni* was in the top 5-cm of tap root 14 days after seeding. There were more *P. alleni* per unit length of tap root in the dry than in the wet regime during the first 7 days, and this trend continued in the top 5-cm of the tap root for 21 days. Nematode density was greater in tap roots than in fibrous roots. The ratio of males to females recovered from roots was significantly higher in the dry than in the wet regime.

1525. NOVAKOVA-PFEIFEROVA, J. 1958. A new fungus disease of soybeans in our country [in Czech]. Preslia 30:369. (Abstr.)

Ascochyta sojaecola was found on soybean in Moravia in 1955 affecting the cotyledons, leaves, and stems. This is the first report for Czechoslovakia.

1526. NOVAKOVA-PFEIFEROVA, J. 1959. A contribution to the recognition of soybean mycosis in Czechoslovakia [in Czech, English summary]. Ceskoslov. Akad. Zemedel. Ved Sborn., Rostlinna Vyroba 32:431–436.

Ascochyta sojaecola first found in Czechoslovakia in 1955 as a serious parasite on soybeans. Geographical distribution, history, taxonomy, symptoms, economic importance, and control are discussed.

1527. NOVAKOVA-PFEIFEROVA, J. 1964. A contribution to the study of *Peronospora manshurica* on soybean in Czechoslovakia [in Czech, German summary]. Ceska Mykol. 18:42–47.

The disease was recorded in Moravia in 1959. Symptoms and geographical distribution are described. Incidence depends on local climatic and soil conditions. Kromerizska Zluta was the most susceptible cultivar, producing heavily infected seeds which germinated to give systemically infected seedlings.

1528. NUGENT, T. J., S. B. FENNE, and W. C. WHITE. 1951. Seed treatment and seed inoculation studies with soybeans. Plant Dis. Reptr. 35:82–83.

Use of arasan seed treatment significantly increased the stand counts of soybeans in this test. Root nodulation was heavier on plants grown from seed that had been inoculated with nitragin just prior to planting. Although arasan plus nitragin increased the average acre yield approximately one bushel over the control and about two bushels over nitragin alone, the yield differences between treatments were not significant.

1529. NUMIC, R. 1962. A contribution to the knowledge of the parasitic fungi in Bosanska Posavina [in Croatian, English summary]. Zashtita Bilja 67/68:141–146.

The following parasitic fungi were observed on soybeans in Yugoslavia during 1960–1961: *Ascochyta pisi* and *Septoria sojina*. The latter is reported for the first time from this territory.

1530. NUMIC, R. 1966. Bacteriosis of soybean in Bosnia and Herzegovina [English summary]. Rad. Polijopriv. Fak. Univ. Saraj. 15:215–230.

Morphological, biochemical, cultural, and pathogenic features of two isolates were typical of *Pseudomonas glycinea*. Inoculation on 11 soybean cultivars resulted in little variation in symptoms.

1531. NUMIC, R. 1970. The effect of infection with *Pseudomonas glycinea* on respiration in leaves of soybean [in Russian]. Proc. Natl. Conf. Gen. and Appl. Microbiol., Bucharest, 4–7 Dec. 1968, pp. 551–554.

After 24 hr. the respiratory quotient was higher in healthy than in inoculated or injured leaves. Later it was similar in all three.

1532. NUMIC, R. 1970. Bakteriofagi fitopathogenih bakteri, ja soje (Bacteriophages of phytopathogenic bacteria of soybean) [English summary]. Rad. Polijopriv. Fak. Univ. Saraj. 19:187–224.

Four bacteriophages of *Pseudomonas glycinea* and four of *Xanthomonas phaseoli* var. *sojense* were isolated from arable soil. One of the latter was isolated from forest soil. Morphology variation of plaques in bacteriophages of *P. glycinea* was less pronounced, and the host range less specific, than those of *X. p.* var. *sojense*. Antisera to the bacteriophages were strongly specific. Bacteriophages of *P. glycinea* were markedly more sensitive to heat than those of *X. p.* var. *sojense*.

1533. NUTTONSON, M. Y. 1952. Ecological crop geography and field practices of the Ryukyu Islands, natural vegetation of the Ryukyus, and agro-climatic analogues in the northern hemisphere. Amer. Inst. Crop Ecology. 106 pp.

Cites the occurrence of *Peronospora manshurica* and *Phakopsora sojae*.

1534. NYHAM, J. W., L. R. FREDERICK, and D. C. NORTON. 1972. Ecology of nematodes in Clarion-Webster toposequences associated with *Glycine max* (L.) Merrill. Proc. Soil Sci. Soc. Amer. 36:74–78.

Toposequence variations in soil and plant properties were characterized and related to nematode populations associated with soybeans. The smallest populations of *Aphelenchus avenae, Helicotylenchus pseudorobustus, Tylenchorhynchus nudus, Tylenchus* spp., and nonstyle-bearing nematodes occurred at the toeslope position within the toposequences. Increases in soil pH, soluble

salts, percentages of soil pores filled with H_2O, soil moisture relative to field capacity, silt plus clay, and soil organic matter within the toposequences were associated with decreases in nematode populations, plant top weight, and the concentrations of N, K, and Ba in the plant tops. Factor analysis of the data revealed that 67–73% of the total site-sampling period variance could be accounted for by soil structure, root activity, soil fertility, dry matter production, and nematode factors. However, nematode populations were more closely correlated with plant variables than with soil variables at each toposequence.

1535. OGOSHI, A. 1970. A root rot disease of peanuts (*Arachis hypogaea* L.) caused by *Cylindrocladium scoparium* Morgan [in Japanese, English summary]. Natl. Inst. Agr. Sci. Tokyo Bull. Ser. C. 24, pp. 153–163.

Soybeans were susceptible to root rot of peanuts upon inoculation.

1536. OKABE, N. 1932. Bacterial diseases of plants occurring in Formosa I. J. Soc. Trop. Agr. 4:470–483.

Symptoms of disease caused by *Bacterium* (= *Xanthomonas*) *phaseoli* var. *sojense* and *Bacterium glycines* (= *Pseudomonas glycinea*) are described. Notes on morphology, physiology, and taxonomy of causal agents are given.

1537. OKABE, N. 1933. Bacterial diseases of plants occurring in Formosa III. J. Soc. Trop. Agr. 5:157–166.

Bacterium sojae var. *japonicum* (= *Pseudomonas glycinea*) causes angular or round, pale to blackish-brown spots with pale yellowish-green to mustard-yellow margins, on the lower leaves of soybeans, which generally become ragged owing to breaking of infected areas. The organism is a large rod with rounded ends, 1.4–5.2 $\times$ 0.4–0.7 μ, on beef extract agar, motile, 1–4 polar flagella forming glistening white colonies, not liquifying gelatin or coagulating milk, aerobic, gram negative, and nonacidfast. Optimum, minimum, and maximum temperatures for growth are 25, 3, and 37 C, respectively.

1538. OKABE, N., and M. GOTO. 1955. Bacterial plant diseases in Japan. I. A list of bacterial diseases and their pathogens [in Japanese, English summary]. Shizuoka Univ. Facul. Agr. (Iwata) Rpt. 5, pp. 63–71.

Lists bacterial spot caused by *Pseudomonas glycinea* and bacterial pustule caused by *Xanthomonas phaseoli* var. *sojense.*

1539. OKADA, T., and T. MORI. 1963. Studies on the diffusion of soil fumigants. I. Diffusion pattern of DD mixture and its killing range for soybean-cyst nematode, *Heterodera glycines,* in soil [in Japanese, English summary]. Hokkaido Natl. Agr. Expt. Sta. Res. Bull. 82, pp. 1–7.

DD mixture was applied in volcanic ash soil infested with cyst nematode, to find the diffusion pattern. The chemical was injected 15 cm deep at the rate of 3 cc per injection. The pattern of diffusion formed an oval centering around the point of injection. The concentration of Cl at the surface was low. The nematodes were killed within 15 cm laterally and between 10–30 cm below surface. The fumigant was least effective in samples located 5 cm below surface.

1540. OKADA, T., and T. MORI. 1964. Studies on the diffusion of soil fumigants. II. Effect of injection depth on the diffusion pattern of a DD mixture and its killing range for soybean-cyst nematodes [in Japanese, English summary]. Hokkaido Natl. Agr. Expt. Sta. Res. Bull. 83, pp. 24–31.

DD mixture was injected 5, 10, and 15 cm below the soil surface. The diffusion pattern of the mixtures and killing range were investigated at each depth after 10, 15, and 20 days. Increased concentration of Cl resulted in increased number of killed nematodes. With increased depth of injection, there was extended pattern of diffusion. Near the surface, effective control was greatest at 5 cm and concentration of Cl was lowest at 15 cm. Injection depth of 10 cm is most effective.

1541. OKADA, T. 1965. Studies on the parasitic distribution of nematodes. II. The growth of soybean roots and the parasitic distribution of soybean-cyst nematodes [in Japanese, English summary]. Hokkaido Natl. Agr. Expt. Sta. Res. Bull. 88, pp. 28–37.

The vertical distribution of the roots of affected soybean plants was more shallow and there were more lateral roots in the layer near the surface than in healthy plants. The growth damage of the affected soybean plants appeared to coincide between plant and roots. The first distribution of the white cysts was affected by distribution of the roots in the early stages of growth of soybean plants. When growth of the root was good, the density of parasitic larvae became higher, and when growth was bad the density became lower. It was considered risky to decide the relationship between damage of the host and parasitism of nematodes by only one stage of nematode development or at only one stage in growth of soybean plants.

1542. OKADA, T. 1965. Studies on the parasitic distribution of nematodes. I. Population density of soybean cyst nematodes in soil and its influence on the distribution of the parasite and root development of soybean [in Japanese, English summary]. Hokkaido Natl. Agr. Expt. Sta. Res. Bull. 87, pp. 74–86.

In general, the more roots there were, the greater the numbers of parasites. Soil infested from the surface to 15 cm deep contained greater numbers of the parasites than nematode-infested top soil turned under to a depth of 30 cm, but plant growth was not poor. Therefore, it could not be determined on the basis of these experiments whether turning the nematode-infested soil in a

field would have a positive effect on the growth of soybean plants.

1543. OKADA, T. 1966. Studies on the parasitic distribution of nematodes. III. Effects of amounts of fertilizer on the growth of soybeans and the parasitic distribution of soybean-cyst nematodes [in Japanese, English summary]. Hokkaido Natl. Agr. Expt. Sta. Res. Bull. 89, pp. 30–36.

In soil infested with high *Heterodera glycines* populations (165 cysts/100 g of dry soil) growth of soybeans was poor and the leaves became yellowish about 50 days after sowing. The amount of damage was decreased by increasing the amount of fertilizer used. Seventy days after sowing, the roots were necrotic and root development was slight compared with that of normal roots. Some new roots, however, proliferated with an increase in fertilizer quantity. The improvement in growth brought about by increased fertilization was more pronounced in plants from soils with high nematode populations than in plants from soils with low nematode populations. Although application of higher amounts of fertilizer gave better growth and yield of soybeans, it also raised the level of the cysts in the soil.

1544. OKADA, T. 1969. Effect of interaction between *Heterodera glycines* Ichinohe and *Rhizobium japonicum* on soybean growth [in Japanese]. Japan. J. Appl. Entomol. Zool. 13:167–173.

1545. OKSENT'YAN, V. G., and A. M. GUNINA. 1968. [Antibiotics in the control of bacteriosis of soybean.] Dokl. Vses Akad. Sel. Khoz Nauk. 1968(3):20–22.

Phytobacteriomycin and *Polymycin* are recommended against *Xanthomonas phaseoli* var. *sojense* and *Pseudomonas glycinea.*

1546. OLIVE, L. S., and E. A. WALKER. 1944. A severe leaf spot of soybean caused by *Phyllosticta sojaecola.* Plant Dis. Reptr. 28:1122–1123.

In Maryland *Phyllosticta sojaecola* is capable of causing severe damage to soybean leaves. The spots located either at the margins or anywhere on leaf lamina may cover the entire leaf. The leaf spots have a dark purple border, usually irregular in outline, surrounding a lighter, brownish inner zone. Numerous pycnidia of *P. sojaecola* may be seen on the lesions. As the spots age the brownish tissue ruptures and eventually falls off, leaving the purple border.

1547. OLIVE, L. S., D. C. BAIN, and C. L. LEFEBVRE. 1945. A leaf spot of cowpea and soybean caused by an undescribed species of *Helminthosporium.* Phytopathology 35:822–831.

A species of *Helminthosporium* apparently heretofore undescribed has been found to cause a severe leaf spotting of cowpeas, with stem infections taking place late in the season. This fungus also causes a light spotting of soybean leaves. Two parasitic races have been isolated. Race 1, isolated from cowpea leaves, causes a severe leaf spotting of cowpeas and a light spotting; while race 2, isolated from soybean leaves, produces a light spotting of soybean leaves and few to many small specks of little consequence on cowpea leaves.

1548. OLIVE, L. S. 1949. Target spot of cowpea and soybean. Mycologia 41:355.

Proposes *Helminthosporium vignicola* (Kawamura) n. comb., with *Cercospora vignicola* Kawamura and *H. vignae* Olive as its synonyms.

1549. OMORI, H. 1964. Research on labor saving in insect and disease control and prevention work. 2. On the effectiveness of wide spraying on diseases and pests of sugar beets and soybeans [in Japanese]. Soc. Plant Prot. N. Japan, Ann. Rpt. 15:17–18.

1550. ONESIROSAN, P. T., D. C. ARNY, and R. D. DURBIN. 1974. Host specificity of Nigerian and North American isolates of *Corynespora cassiicola.* Phytopathology 64:1364–1367.

Soybean isolates from southern United States and Mexico were highly virulent on soybean, sesame, eggplant, and cotton. The fungus has a wide host range but host-specific strains appear too numerous and quite varied in range of specificity.

1551. OOSTENBRINK, M. 1951. [Het erwtencystenaaltje, *Heterodera gottingiana* Liebscher. in Nederland.] Tijdschr. o. Plantenz. 57(2):52–64.

The Dutch pea root eelworm infests peas, broad beans, vetches, and lentils, but red clover, kidney beans, and lupines are not susceptible. The Dutch clover root eelworm infests red clover, white clover, and some other Leguminosae, but not peas. Lucerne and soybeans, which are attacked in the U.S.S.R. and Japan, proved susceptible, thus there must exist other *Heterodera* strains attacking the Leguminosae.

1552. OOSTENBRINK, M. 1960. The genus *Heterodera. In* Nematology, J. N. Sasser and W. R. Jenkins (eds.), Chapel Hill, N.C., pp. 206–211.

This extensive paper on the *Heterodera* species has a key for identification of the species, based on mature cysts and their contents. A table lists the species of *Heterodera,* type of host, and plant families damaged by each.

1553. OOSTENBRINK, M. 1961. Nematodes in relation to plant growth. II. The influence of a crop on the nematode population. Netherlands J. Agr. Sci. 9:55–60.

Population studies in three rotation trials demonstrated the marked influence of cropping on nematode popula-

tions in cultivated soil. One year's cultivation of different crops caused shifts in population densities of at least four different plant parasitic nematodes in both a silt soil and a sandy soil. The influence of one or two years' cultivation of a crop may be noticeable in the nematode infestation of subsequent crops for at least two seasons. This appears to hold for *Heterodera* and *Meloidogyne* as well as for migratory root-infesting species, and it stresses the decisive influence of one-sided cultures on the appearance of different *Heterodera* species in a field and gives an insight into the epidemiology of *Heterodera* infestations and the preventative value of crop rotation.

1554. ORANSKAYA, A. (ed.) 1971. [Diseases and pests of soybean in the south Far East and measures against them.] Vladivostok, U.S.S.R. 183 pp.

1555. ORBIN, D. P. 1970. Investigations on the biology and pathology of spiral nematode, *Helicotylenchus dihystera,* on soybeans. Ph.D. thesis, Auburn University, Auburn, Ala. 110 pp.

1556. ORBIN, D. P., and E. J. CAIRNS. 1971. Histopathology of soybean roots infected with *Helicotylenchus dihystera* (Cobb) Sher. J. Nematol. 3:322–323. (Abstr.)

An abstract of entry 1557.

1557. ORBIN, D. P. 1973. Histopathology of soybean roots infected with *Helicotylenchus dihystera.* J. Nematol. 5:37–40.

Soybean roots infected with *Helicotylenchus dihystera* in a greenhouse were stained with acid fuchsin in lactophenol or sectioned and stained with safranin and fast green. Adults and larvae were observed in semi-endoparasitic and endoparasitic feeding positions. Adults, larvae, and eggs were observed within the root cortex posterior to the region of maturation. Small brown lesions, affecting the walls of 6 to 10 cells, were observed in the immediate vicinity of the nematode. Endoparasitic nematodes were usually coiled within the walls of one or two cells. Cytoplasm of infected cells appeared normal and there was no indication of nuclear proliferation. Walls of infected cells were thickened and lignified but there was no indication of swelling or giant cell formation. Uncoiled nematodes usually were aligned parallel to the vascular tissue, but were not consistently oriented with respect to the root apex. Nematodes moved through cell walls rather than between them; however, no persistent burrows were observed.

1558. ORELLANA, R. G. 1966. A new occurrence of tobacco ringspot of guar in the United States. Plant Dis. Reptr. 50:7–10.

Tobacco ring spot virus from field-infected guar (*Cyamopsis tetragonoloba*) is transmitted to soybeans, cowpea, tobacco, datura, squash, tomato, and peas.

1559. OSBORNE, W. W. 1968. Soybean sting nematode, *Belonolaimus* sp. Amer. Phytopath. Soc. Fungicide and Nematicide Tests, Results of 1967. 23:132.

The soil type — Norfolk sandy loam — is favorable for the sting nematode. Nemagon, EC-2 was applied at the rate of 2.25 gal./acre (broadcast equivalent) to a 6-in. depth in the row at time of planting soybeans. The cultivar Lee was planted May 18. Soil samples were collected August 20 and processed for nematode counts. Soybeans were harvested November 10 and placed in a drying chamber maintained at 110 F for 3 days to equalize moisture content. Beans were then weighed and yield/-acre was ascertained. Rate and method of chemical application employed gave good nematode control, crop growth response, and yield.

1560. OSBORNE, W. W. 1968. Soybean nematodes, *Meloidogyne hapla, Pratylenchus* sp., *Helicotylenchus* sp., *Criconemoides* spp., *Belonolaimus* sp., and *Tylenchus* sp. Amer. Phytopath. Soc. Fungicide and Nematicide Tests, Results of 1967. 23:132.

The test consisted of eight treatments replicated four times in a randomized block design. Lee soybeans were planted May 15, four days after chemical application. Sixty-pound rates of furadan and mocap were used to evaluate two methods of chemical application: (a) 12-in.-wide band of chemical incorporated to an 8-in. depth, (b) 6-in.-wide band of chemical placed in a furrow 4 in. deep and covered with soil (in-furrow treatment). Other chemicals and rates were applied on 12-in.-band and incorporated 8 in. Furadan and mocap were 10% granular formations. Thimetzinophos was a granular formulation containing 7.5% active thimet and 7.5% active zinophos. Furadan and mocap applied on 12-in.-wide bands and incorporated 8 in. produced higher yields than the in-furrow method of chemical application. Sting nematode counts in the check were highest on the June 15 sampling date. Early sting nematode damage probably accounts in part for lower yield in the check. Soybeans in furadan treated plots grew faster than soybeans in other treatments. There was considerable early phytotoxicity with furadan at 80 lb./acre. Young plants exhibited necrosis of leaf margins. When comparing yield with nematode counts it appears that furadan may hinder the feeding mechanism of certain ectoparasitic nematodes, stimulate soybean plant growth and flowering, and/or control other soybean pests not being considered in this research.

1561. OSBORNE, W. W. 1968. Soybean nematodes, *Pratylenchus* sp., *Helicotylenchus* sp., *Criconemoides* sp., *Tricodorus* sp., *Tylenchorhynchus* sp., *Xiphinema* sp., and *Tylenchus* sp. Amer. Phytopath. Soc. Fungicide and Nematicide Tests, Results of 1967. 23:133.

Soybeans were produced in this field the year prior to this test. There was a low yield and a nematode assay revealed the presence of the nematode genera listed

above. Methylbromide was applied as a 2-ft.-wide treatment down the row under a plastic cover. Chemicals were applied June 16; soil temperature was 66 F. The plastic cover remained in place for 3 days, was removed, and all treatments seeded the following day. Soil samples were taken for nematode counts at time of soybean harvest (November 10). Mocap at 80 lb. may have been slightly phytotoxic; beans appeared to be slightly stunted early in the season. Nematode control was generally superior in this treatment when compared with mocap 40 lb./acre; however, yield was slightly higher in the 40 lb./acre treatment with mocap. Methylbromide produced good nematode control and the highest yield/acre.

1562. OSBORNE, W. W. 1969. Soybean northern root knot, *Meloidogyne hapla,* sting nematode *Belonolaimus* sp. Amer. Phytopath. Soc. Fungicide and Nematicide Tests, Results of 1968. 24:128.

Soil was a deep sandy loam with a pH of 5.8 and vernolate was applied for weed control. Chemicals were applied May 15, soil temperature was 68 F, and soil moisture was adequate. Soybean cultivar Lee was planted at the rate of 2.5 pecks per acre on May 16. Beans were harvested November 16, threshed, and dried for 4 days at 110 F to equalize moisture content before weighing and determining yield. Treatments were evaluated for relative growth and vigor on June 18 and August 14. Nematode control was being ascertained from soil samples collected at three posttreatment dates. Compilation of data from the last sampling date was not completed; therefore, nematode counts are not included in data. Data from samples collected on the first two sampling dates show in general an inverse relationship between nematode populations and soybean yield.

1563. OSWALD, T. H., and T. D. WYLLIE. 1973. Effects of growth regulator treatments on severity of charcoal rot disease of soybean. Plant Dis. Reptr. 57: 789–792.

Soybeans grown in the growth chamber and in the field were treated with growth regulators prior to inoculation with *Macrophomina phaseolina,* the pathogen of charcoal rot. Indole-3-acetic acid and kinetin increased, did not alter, or decreased disease severity, depending on the applied concentrations and growth conditions. The gibberellins and triiodobenzoic acid decreased disease severity under all experimental conditions. Frequent treatments with gibberellins or triiodobenzoic acid at low concentrations in the field protected soybeans without noticeably changing plant growth and development.

1564. OSWALD, T. H., and T. D. WYLLIE. 1973. The use of glucono-deltalactone for controlling charcoal rot disease in soybean. 2nd Internatl. Cong. Plant Path. Abstrs. 0955.

Glucono-delta-lactone lessened severity of charcoal rot disease of soybean in all plants that were variously pretreated with growth regulators. Constancy of the protection would not be expected if the lactone interacted with host metabolism in order to trigger some mechanism of resistance. The changes in appearance of plants, following treatment with growth regulators, indicate that such interaction would have to occur with host metabolism that varies according to growth regulator treatments. Protection was interpreted as being the result of direct interaction between glucono-delta-lactone and metabolism of the pectolytic fungus, *Macrophomina phaseolina.* In in vitro studies, the lactone did not inhibit fungal pectinases, but suppressed one of these enzymes, exopolygalacturonase. The interpretation offered for disease protection is that disruption of extracellular digestion of pectin, via suppression of polygalacturonase, is perhaps significant in lessening severity of charcoal rot disease in soybean.

1565. OVCHINNIKOVA, A. M. 1968. *Cercospora* on soybean in Primorsk (Pacific Coastal) region [in Russian]. Zashch Rast. Mosk. 13:27–28.

Cercospora sojina is widespread in this region where it attacks all local cultivars, only Capital being practically immune, and may cause an 8-fold reduction in seed yield. The disease is most harmful in early stages of plant development where the infected leaves fall and plants become weakened. Overwintered leaves bearing conidia are main source of inoculum. In fungicide trials 2–3 sprays of bordeaux mixture proved most effective and ziram + copper zineb and dyrene were also promising.

1566. OVCHINNIKOVA, A. M. 1970. [The pathogenic mycoflora of soybean.] Trudy vses. Inst. Zashek Rost. 29:73–80.

Of 30 spp. detected, *Colletotrichum glycines* (= *C. dematium* var. *truncata*), *Verticillium dahliae,* and *Uromyces sojae* (= *Phakopsora pachyrhizi*) were newly recorded in the Soviet Far East. Incidence and distribution of the mycoflora of soybean (120 spp.) are briefly reviewed.

1567. OVCHINNIKOVA, A. M. 1973. Diseases of soybean in the Far East [in Russian]. Trudy Dal'nevost. N II 15 Kh. 13:135–142.

The most important pathogens in Soviet Far East are *Cercospora sojina, Peronospora manshurica, Septoria glycinea,* and soybean mosaic virus. Symptoms are described and controls indicated.

1568. OWEN, F. V. 1927. Hereditary and environmental factors that produce mottling in soybeans. J. Agr. Res. 34:559–587.

All cultivars of soybeans with yellow or green seed coats included in this study proved to be subject to mottling. A study of hereditary and environmental factors showed that both were important. Certain selections consistently produced less mottling than others, but badly mottled

seed has been produced from selections where mottling was least expected by supplying favorable environmental conditions for the formation of pigment in the seed coat. The black and brown pigments responsible for mottling were found to be glucosides, and an explanation of their production by means of an accumulation of sugars has been considered. The most striking evidence for this theory was obtained from the observation that mottling was greatly increased by reviving the growth of the plant after the seeds were practically mature.

1569. OWENS, J. V. 1951. The pathological effects of *Belonolaimus gracilis* on peanuts in Virginia. Phytopathology 41:29. (Abstr.)

The sting nematode, *Belonolaimus gracilis,* has hitherto been reported only from corn and pine roots in Florida. Investigations conducted during the 1950 growing season in the vicinity of Holland, Va., indicate that it can cause serious damage to peanut crops. When infestation is heavy the lateral roots are gnarled and stubby; frequently only the tap root is left. Such plants show a marked decrease in yield of nuts and peanut hay. Peanuts growing in flasks of agar were inoculated with specimens of *Belonolaimus;* minute necrotic lesions were along the tap root as a result of their feeding, and some specimens were observed in the act of feeding on the roots. This nematode also was found attacking cotton, corn, and soybean crops in this area.

1570. OWENS, L. D., and D. A. WRIGHT. 1965. Rhizobial induced chlorosis in soybeans: isolation, production in nodules and varietal specificity of the toxin. Plant Physiol. (Kutztowen) 40:927–930.

Rhizobial-induced chlorosis was found to be caused by a single, nonspecific, phytotoxic amino compound produced in the nodules of certain soybean-rhizobial associations. The phytotoxin was recovered in substantial quantities from young chlorotic leaves, but not in older, normal-appearing leaves of soybean plants. Addition of microgram quantities of the purified toxin to the nutrient solution induced chlorosis in seedlings of susceptible soybean cultivars. The amount of toxin required was less than the amount found in the nodules of single soybean plants. More than four times as much toxin was required to induce chlorosis in seedlings of resistant cultivars. The resistant response of soybean cultivars nodulated by pathogenic rhizobial strains was found to be associated with the prevention of phytotoxin synthesis or accumulation in the nodule. A nonidentified amino acid accumulated to higher levels in nodules of soybean-rhizobial associations where the toxin was produced than in associations where it was not produced. No other differences in kind and amount of free amino acids in the nodules were associated with toxin formation.

1571. OWENS, L. D., and D. A. WRIGHT. 1965. Production of the soybean chlorosis toxin by *Rhizobium japonicum* in pure culture. Plant Physiol. (Kutztowen) 40:931–933.

A chlorosis-inducing phytoxin, formerly known to be produced only in soybean nodules, was found to be synthesized by several strains of *Rhizobium japonicum* in pure culture. Two of the strains have not been observed to induce chlorosis in soybeans, while two chlorosis-inducing strains failed to produce detectable quantities of the toxin in pure culture. Production of the phytotoxin by a selected strain was greatly affected by the culture medium. Maximum production per unit volume of culture was obtained with cells grown in yeast-extract medium supplemented with casamino acids and harvested at the end of the logarithmic phase of growth. Procedures for isolating milligram quantities of the phytotoxin are described.

1572. OWUSU, G. K., N. E. CROWLEY, and R. I. B. FRANCKI. 1968. Studies of the seed transmission of tobacco ringspot virus. Ann. Appl. Biol. 61:195–202.

The age of a plant at time of infection was the most important factor determining the amount of infected seed produced. The inability of tobacco ring spot virus (TRSV) to infect maturing embryos was not due to slowness of virus movement within the host. TRSV was consistently found in the embryo and perisperm tissues of infected seeds but not in the testa. All attempts to control seed-transmission of TRSV in soybean failed. Storage for 7 mo. and heat treatment of seed at temperatures near the thermal inactivation point of the virus, failed to inactivate TRSV in infected seeds. Spraying of TRSV-infected plants with 2-thiouracil and 8-azaguanine had no effect on host infection and did not prevent seed-transmission.

1573. OWUSU, G. K. 1971. A suspected virus from soybean infecting cocoa seedlings. Ghana J. Agr. Sci. 4: 201–204.

Symptoms on soybean were caused by a nonidentified virus which was mechanically transmitted to cocoa seedlings in the glasshouse. The causal agent was present in testa tissues but not in perisperm or embryo of seeds of infected plants. Evidence suggests that the virus is seedborne.

1574. OZAKI, K., and K. ASAI. 1963. Studies on the rotation systems. II. The relationships between crop sequence and the soybean-cyst nematode population in the soil [in Japanese, English summary]. Hokkaido Natl. Agr. Expt. Sta. Res. Bull. 81, pp. 11–21.

1575. PADY, S. M. 1943. Plant diseases in Kansas and Nebraska. Plant Dis. Reptr. 27:375–377.

Records the occurrence of *Xanthomonas phaseoli* var. *sojense.* Late-planted fields had smallest amount of infection. Mosaic virus and pod and stem spot (unknown cause) also were reported.

1576. PADY, S. M. 1944. Bacterial pustule in Kansas. Plant Dis. Reptr. 28:835.

Records the occurrence of *Xanthomonas phaseoli* var. *sojense* and it was the only disease observed in August 1944.

1577. PADY, S. M. 1944. Notes on the plant disease survey in Kansas, August to November, 1943. Plant Dis. Reptr. Suppl. 149:313–316.

Xanthomonas phaseoli var. *sojense* caused some defoliation. The pathogen is seedborne. Records the occurrence of *Diaporthe sojae* (= *D. phaseolorum* var. *sojae*), *Glomerella glycines, Sclerotium bataticola* (= *Macrophomina phaseolina*), and mosaic virus.

1578. PADY, S. M. 1944. Notes on diseases observed in the Nebraska plant disease survey, August to November, 1943. Plant Dis. Reptr. Suppl. 149:311–313.

Reports occurrence of *Xanthomonas phaseoli* var. *sojense, Glomerella glycines, Sclerotium bataticola* (= *Macrophomina phaseolina*) and mosaic virus. Pod and stem spot occurred, of unknown cause. The spots are black, roughly elliptical, sunken, and shiny. Infected pods produce no seeds and are deformed.

1579. PAI, C. K. 1957. Notes on the Peronosporaceae in northeastern China [in Chinese, English summary]. Acta Phytopath. Sinica 3:137–154.

Taxonomic notes on *Peronospora manshurica* on *Glycine max* and *G. ussuriensis.*

1580. PALFI, G. 1967. Pipecolic acid as an indicator of disturbed amino acid metabolism in the infected rice, potato, and tobacco plants. Acta Biol. Szeged. 13(1–2): 37–39.

Pipecolic acid was identified in leaf extracts from eight crops including soybean infected with bacteria or viruses, but not in leaves of healthy control plants.

1581. PALFI, G., and L. DEZFI. 1968. Pipecolic acid as an indicator of abnormal protein metabolism in diseased plants. Plant Soil 29:285–291.

During the study of the free amino acid spectrum of diseased soybean leaves an unknown compound was detected, the occurrence of which was correlated with an abnormal physiological condition of the plants or with some disturbance in amino acid or protein metabolism. On chromatograms this substance stains blue following fixation with $CuNO_3$. After purification with the aid of bacteria, this blue substance was identified as pipecolic acid. Since pipecolic acid could be found in the leaves of rice sprayed with maleichydrazide, but not in control plants, it would seem that it is a metabolic product of growth inhibition.

1582. PANDEY, M. C., and R. D. WILCOXSON. 1970. The effect of light and physiologic races of Leptosphaerulina leaf spot of alfalfa and selection for resistances. Phytopathology 60:1450–1462.

Leptosphaerulina briosiana can infect soybeans.

1582a. PAPAVIZAS, G. C., and N. G. KLAG. 1974. Quantitative determination of *Macrophomina phaseolina* in soil. Proc. Amer. Phytopath. Soc. 1:154. (Abstr.)

A selective medium and a technique were developed for direct isolation of *Macrophomina phaseolina* from soil, and for quantitative estimation of its inoculum density in soil. The basal agar medium contained potato-dextrose agar and 25 and 100 mg/liter of chlortetracycline HCl and streptomycin SO_4, respectively. The best combination of antimicrobial agents added to the basal medium for successful isolation was diazoben + oxgall + rose bengal (PDA-DORB). Sclerotia in soil were mechanically concentrated by wet-sieving. Soil saprophytes were reduced by washing the residue retained on a 0.044 mm sieve (325-mesh) with tap water for 1 min. and by exposing the concentrate to 0.25% NaClO for 8 min. The final soil dilution was prepared by transferring the 0.044 mm-sieve residue to 100 ml of water. One-ml aliquots were removed from the final dilution and pipetted onto the surface of 1- to 2-day old PDA-DORB in petri dishes. The dishes were incubated at 30 C for 1 week. The average recovery of sclerotia from artificially infested soils was 80%. Numbers of sclerotia in naturally infested soils averaged from 0–1,000/g soil. The majority of colonies that developed on the media from naturally infested soils originated from free sclerotia in soil.

1583. PAPE, H. 1921. [Pilzlich schädlinge der sojabohne.] Mitteil. Biol. Reichsanst. Land Forstw. 21:36–42.

Two diseases caused by *Sclerotinia libertiana* (= *Whetzelinia sclerotiorum*) and *Botrytis cinerea* are fully described. Both attack pods as well as growing plants.

1584. PAPE, H. 1921. Observations on the causation of disease by *Botrytis* [in German]. Gartenflora 70:48–50.

Botrytis sp. first attacked the withering young pods on the upper part of the plant and then proceeded to the main axis. In some cases it was noted that fungus was transmitted by direct contact from tip of pod to stalk.

1585. PARASHAR, R. D., and C. LEBEN. 1972. Detection of *Pseudomonas glycinea* in soybean seed lots. Phytopathology 62:1075–1077.

Pseudomonas glycinea was detected in lots of 500 soybean seeds by predisposing germinating seeds and seedlings to conditions favoring the formation of typical water-soaked lesions on seedling cotyledons. These conditions included the wounding of cotyledons of partly germinated seeds and the emergence of seedlings into water-saturated air.

1586. PARBERY, D. G., and C. K. LEE. 1972. An-

thracnose of soybeans. Australian Plant Path. Soc. Newsltr. 1:10–11.

First report of occurrence of *Colletotrichum dematium* f. *truncata* in Australia. The fungus causes poor seed germination and cankers on cotyledons. The disease is potentially serious.

1587. PARK, J. S., and S. C. HAN. 1968. Studies on resistant varieties to the soybean cyst nematode, *Heterodera glycines,* Ichinohe [in Korean, English summary]. Off. Rur. Devel. Korea, Res. Rpt. 11, pp. 67–73.

Root cyst counts were used to assess the resistance of 41 soybean cultivars to *Heterodera glycines* (yellow-dwarf disease) in trials in Korea. In order of resistance the cultivars were PI-90763, PI-84751, Medium Green, Haman, Jaerae, Buseok, L9-673. Changdan-baekmok was more resistant than most other Korean recommended cultivars. Late-maturing cultivars were more resistant than early or medium ones.

1588. PARK, J. S., S. C. HAN, and Y. P. RI. 1969. Studies on varietal resistance of soybean to *Heterodera glycines* and on the damage caused by it. J. Plant Prot. (Suwon, Korea) 7(1):21–25.

1589. PARK, M. 1941. Report on the work of the division of plant pathology. Acting Dir. Agr. Ceylon, Admin. Rpt. 1939, pp. D20–D22.

New record of *Uromyces sojae* (= *Phakopsora pachyrhizi*) in Ceylon (Sri Lanka).

1590. PARKER, M. B., N. A. MINTON, O. L. BROOKS, and C. E. PERRY. 1973. Influence of subsoiling, fertility and nematicide treatments on soybeans grown on a Marlboro soil infested with lance nematodes. Georgia Agron. Abstr. Georgia Sect. Amer. Soc. Agron. and Soil Sci. No. 16, p. 10. (Abstr.)

1591. PARRIS, G. K. 1940. A check test of fungi, bacteria, nematodes, and viruses occurring in Hawaii, and their hosts. Plant Dis. Reptr. Suppl. 121 pp.

Reports *Heterodera marioni* and *Pratylenchus pratensis* on *Glycine sojae* in Hawaii. Also lists predaceous nematodes.

1592. PARRIS, G. K. 1959. A revised host index of Mississippi plant diseases. Mississippi State Univ. Bot. Dept. Misc. Pub. 1. 146 pp.

Cites 18 fungi, bacteria, and viruses that occur on soybeans in Mississippi.

1593. PATEL, M. K., Y. S. KULKARNI, and G. W. DHANDE. 1949. *Dolichos biflorus* L. — a new host of *Xanthomonas phaseoli sojense* (Hedges) Dowson. Current Sci. (India) 18:83–84.

The pathogen was found on *Dolichos biflorus* in the Belgaum district of Poona, India, August 1948. The organism resembles *Xanthomonas sojense* in morphological characters. Since both pathogens are cross-inoculable, *D. biflorus* is considered a new host for this pathogen.

1594. PATEL, M. K., and Y. S. KULKARNI. 1954. A review of bacterial plant disease investigation in India. Indian Phytopath. 6:131–140.

There are strong reasons for believing that *Xanthomonas phaseoli sojense* gained entry into India from the west, since India depended largely upon foreign countries for seeds of soybeans.

1595. PATEL, P. N., J. K. JINDAL, and M. V. B. RAO. 1972. Studies on resistance in crops to bacterial diseases in India. III. Pustule resistance in soybean. Indian Phytopath. 25:168–171.

Of 225 soybean lines and cultivars tested, 34 were resistant. U.S. cultivars Bragg, Bossier, Clark-63, Hampton-226, Hill, Hood, Lee, Pickett, Stuart, Rubel, Hardee, Amsoy, Davis, Semmes, Perry, Harosoy 63, S-379-Sioto (Morocco), Otootan, Nanking No.417, Avoyelles (Italy), Bourke (Italy), 11G-1-12 (Nigeria), and Lincoln were resistant.

1596. PATEL, V. C., and H. N. PITRE. 1971. Transmission of bean pod mottle virus to soybean by the striped blister beetle, *Epicauta vittata.* Plant Dis. Reptr. 55:628–629.

Bean pod mottle virus (BPMV) was successfully transmitted to soybean, Lee cultivar, by the striped blister beetle, in greenhouse tests. This is the first record of this species as a vector of BPMV.

1597. PATHAK, N. C., and R. N. GHOSH. 1962. Fungi of Uttar Pradesh (India). Lucknow (India) Natl. Bot. Gard. Bull. 62. 146 pp.

Cercospora daizu (= *C. sojina*) reported on soybean.

1598. PATINO, H. C. 1967. [Diseases of oleaginous annuals in Colombia.] Agr. Trop. 23:532–539.

Symptoms are described for *Xanthomonas phaseoli* var. *sojense, Sclerotium bataticola* (= *Macrophomina phaseolina*), *S. rolfsii, Rhizoctonia solani, Glomerella glycines, Colletotrichum truncatum* (= *C. dematium* f. *truncata*), *Fusarium oxysporum* f.sp. *tracheiphilum, Fusarium* sp., *C. truncatum* complex, *Cercospora kikuchii, Diaporthe phaseolorum* var. *sojae,* and *Sclerotinia* (= *Whetzelinia*) *sclerotiorum* on soybean, in Colombia.

1599. PATRICK, Z. A. 1954. The antibiotic activity of soil microorganisms as related to bacterial plant pathogens. Canad. J. Bot. 32:705–735.

Pseudomonas glycinea appeared to be especially vulnerable to the deleterious effects of antagonistic soil microflora. In plantings made, 118 antagonistic microorganisms were observed. Fifty-six of these were isolated, of which 14% produced large inhibition zones.

1600. PAUL, H. L. 1961. The form and structure of phytopathogenic viruses [in German]. Zentbl. f. Bakt., Abt. II, 114:694–717.

A review of the literature (203 citations) compiled at Biologischen Bundesanstalt, Brunswick, Germany. The measurements of soybean mosaic virus are given in a table of comparison of plant viruses whose form and structure are known.

1601. PAUL, W. R. C. 1939. Report on the work of the division of plant pathology. Dir. Agr. Ceylon, Admin. Rpt. 1938, pp. D41-D45.

A stem disease caused by *Rhizoctonia bataticola* (= *Macrophomina phaseolina*) occurred on soybean in Sri Lanka.

1602. PAXTON, J. D., and D. W. CHAMBERLAIN. 1967. Acquired local resistance of soybean plants to *Phytophthora* spp. Phytopathology 57:352–353.

Harosoy soybean plants can be locally cross-protected with *Phytophthora cactorum* against subsequent infection by *P. megasperma* var. *sojae*. Similarly, soybean strain D60-9647 can be cross-protected against race 2 of *P. megasperma* var. *sojae* (to which it is normally susceptible) by prior inoculation with race 1 of *P. megasperma* var. *sojae* (to which it is resistant). Production of a phytoalexin by soybean is implicated in this cross-protection.

1603. PAXTON, J. D., and J. A. FRANK. 1969. The time sequence for phytoalexin production in Harosoy and Harosoy 63 soybeans. Proc. 11th Internatl. Bot. Cong., p. 167. (Abstr.)

An abstract of entry 690.

1604. PAXTON, J. D. 1973. Plants "self" recognition may aid disease control. Illinois Res. 15:13.

A popular article on the role of phytoalexin in soybean resistance to *Phytophthora megasperma* var. *sojae, P. cactorum,* and *P. megasperma.*

1604a. PAXTON, J. D., and B. J. JACOBSEN. 1974. A new method for screening soybeans for Phytophthora root rot resistance. Proc. Amer. Phytopath. Soc. 1:67–68. (Abstr.)

An extract from *Phytophthora megasperma* var. *sojae* (*Pms*) may be used to induce phytoalexin production and allow soybean plants resistant to *Pms* to be distinguished from plants susceptible to *Pms.* Sterile soybean seeds are germinated for 3–5 days in petri plates under moist conditions or room temperature. Seedlings are then wounded by shaking with carborundum or sandpaper and coated with a concentrated *Pms* inducer solution. After 24–48 hr. incubation at room temperature phytoalexin produced is extracted by immersing seedlings in a 0.01M K phosphate buffer (pH 7.0). Phytoalexin production is measured by recording absorption at 490 nm. A differential response to inducer can be detected between Harosoy (*Pms* susceptible) and Harosoy 63 (*Pms* resistant). This technique shows promise in disease resistance screening since it eliminates one biological variable in the screening process and circumvents the destruction of susceptible individuals which the breeder may wish to save for other work.

1605. PAXTON, J. D., and D. P. ROGERS. 1974. Powdery mildew of soybeans. Mycologia 66:894–897.

The disease occurred in Illinois fields in 1972, and infected plants in greenhouses developed abundant cleistothecia in winter 1972. The cleistothecia, 86–120 μ in diameter, contained several asci, and appendages were 2–4 times as long as diameter of cleistothecia, when mature mostly 180–280 $\mu \times 7$–$7.5\ \mu$. Tips were up to six times dichotomously branched. The organism is identified as *Microsphaera diffusa,* not *Erysiphe polygoni* as originally reported.

1606. PEACOCK, F. C. 1956. The reniform nematode in the Gold Coast. Nematologica 1:307–310.

Eight new host records for the reniform nematode (*Rotylenchulus reniformis*) were compiled near and around Accra, Gold Coast, Ghana. The life cycle of this nematode on soybean was as short as or shorter than the minimum of 25 days reported by Linford and Oliveira. Soybean was considered a highly susceptible host.

1607. PEACOCK, F. C. 1956. The reniform nematode in the Gold Coast. Nature 177:489.

Soybean was a host that allowed the reniform nematode (*Rotylenchulus reniformis*) to reproduce at three sites in the Gold Coast, Ghana.

1608. PEACOCK, F. C. 1957. Studies on root-knot nematodes of the genus *Meloidogyne* in the Gold Coast. I. Comparative development on susceptible and resistant host species. Nematologica 2:76–84.

Development of the root-knot nematode on a number of hosts in the Gold Coast was studied and the host/parasite relationship was compared. The life cycle of the most advanced individuals on tomato and cowpea was completed in 28 days at soil temperatures of 26–31 C; on maize, soybean, and tobacco the life cycle was 33 days, but individual variation was considerable and the average life cycle differed much from host to host.

1609. PEDERSON, V. D. 1958. A new method of obtaining systemic infection of soybeans by *Peronospora manshurica.* Proc. Iowa Acad. Sci. 65:146–149.

Systemic infection in soybean seedlings was obtained with the fungus *Peronospora manshurica* by inoculating seed with infected soybean leaves containing oospores. Seed was inoculated by placing finely pulverized leaf material between cotyledons. It may be possible, there-

fore, to maintain races of the downy mildew fungus by preserving dried, infected soybean leaves that contain oospores.

1610. PEDERSON, V. D. 1960. Self inhibition of germination of conidia of *Peronospora manshurica.* Proc. Iowa Acad. Sci. 67:103–108.

The inhibitor reducing germination of conidia from soybeans on water agar diffused readily in water. It was lost after a few days' exposure to air, but accumulated when conidia were stored in corked test tubes. The most significant aspect of self-inhibition phenomenon is that conidia may be prevented from germinating until they are scattered.

1611. PEDERSON, V. D. 1961. Downy mildew of soybeans. Diss. Abstrs. 22:703.

Systemic infection of soybean by *Peronospora manshurica* was obtained by inoculating seeds with oospores from encrusted seeds or diseased leaf material. The highest percentage of seedlings became systemically infected when activated charcoal mixed with oospores was used as inoculum. Conidia remained viable at least 19 days when stored aerobically or anaerobically in water at 1 C and for at least 14 days when stored intact in −14 or 1 C after sporulation on leaves. Percentage germination of conidia was inversely proportional to the duration of light and to their concentration because of an inhibitor. When infected seedlings were exposed to light daily for 6, 12, or 18 hr., percentage of leaf area that became affected was inversely proportional to the exposure. Oospores developed in leaf tissues simultaneously with the onset of chlorosis. They formed earlier and in greater numbers in short than in long periods of exposure to light. The environmental factor most influential in inducing secondary infection was persistance of dew, profuse sporulation being favored by 10 hr. of heavy dew. Peak conidial discharge occurred concurrently with rapid drying of field plants.

1612. PENDER, M. T. 1957. Soybean-cyst nematode, *Heterodera glycines.* Proc. Assoc. So. Agr. Workers 54th Ann. Conv., p. 142. (Abstr.)

Reports the occurrence of *Heterodera glycines* on soybeans, confined to 1,680 acres in North Carolina. Quarantine measures are in force to prevent further spread of the nematode. Control is mainly by growing nonhost crops in infested soil.

1613. PERRY, V. G., G. C. SMART, JR., and R. S. MULLIN. 1967. The soybean cyst nematode, *Heterodera glycines,* found in Florida. Plant Dis. Reptr. 51: 1066.

The soybean-cyst nematode *Heterodera glycines* has been reported for the first time in Escambia County, Florida.

1614. PERRY, V. G., R. S. MULLIN, and G. C. SMART, JR. 1967. The soybean cyst nematode in Florida. Proc. Soil and Crop Sci. Soc. Fla. 27:1–4.

A review article, briefly describing life cycle, host damage, identification, and control measures.

1615. PERSON, L. H. 1944. List of plant diseases observed during surveys in Mississippi and Louisiana, August to November, 1943. Plant Dis. Reptr. Suppl. 148: 280–283.

Records the occurrence of *Cercospora sojina, Diaporthe sojae* (= *D. phaseolorum* var. *sojae*), *Sclerotium bataticola* (= *Macrophomina phaseolina*), *S. rolfsii, Pseudomonas glycinea, Xanthomonas phaseoli* var. *sojense,* and mosaic virus.

1616. PERSON, L. H. 1944. Parasitism of *Rhizoctonia solani* on beans. Phytopathology 34:1056–1068.

Isolates of *Rhizoctonia solani* are classified into four groups according to their parasitism. Group 1 consisting of isolates from sugar cane and potatoes is nonpathogenic to soybeans, and group 3 consisting of rice isolate is weakly pathogenic to soybeans. Group 2 consisting of pea isolates and group 4 consisting of isolates from beans, tomato, eggplant, and sugar beet are pathogenic to soybeans but can be further differentiated on soybeans and other legumes.

1617. PETCH, T. 1922. Additions to Ceylon fungi. II. Peradeniya (Ceylon) Roy. Bot. Gard. Ann. 7:279–322.

A new species of *Phomopsis* on dead stems of seedlings, named *P. phaseoli,* was collected July 1918 at Peradeniya, Ceylon. Pycnidia immersed, scattered, black, thin-walled, lenticular, 0.25 mm diameter. Spores hyaline, narrow-oval, 3–6 $\times$ 1.5–2 μ, or linear, uncinate, 14–16 μ long.

1618. PETERSON, E. A. 1961. Observations on the influence of plant illumination on fungal flora of roots. Canad. J. Microbiol. 7:1–6.

Greenhouse and plant growth room experiments showed that shading of plants had no appreciable effect on vegetatively active fungi colonizing the primary roots of soybean seedlings growing in fertile, disease-free soil. Although marked differences in plant development were obvious, the general pattern of root colonization was essentially the same for the two levels of illumination used. Results suggest that the saprophytic fungi which normally colonize the roots of healthy plants may also colonize roots of abnormal plants provided that the soil is relatively free from plant pathogenic forms. Majority of cultures from soybeans proved to be species of *Fusarium.*

1619. PETERSON, E. A., and H. KATZNELSON. 1964. Occurrence of nematode-trapping fungi in the rhizosphere. Nature 204:1111.

Nematode-trapping fungus *Arthrobotrys oligospora* occurs in the soybean rhizosphere and reduces nematode populations.

1620. PETERSON, E. A., and H. KATZNELSON. 1965. Studies on the relationships between nematodes and other soil micro-organisms. IV. Incidences of nematode trapping fungi in the vicinity of plant roots. Canad. J. Microbiol. 11:491–495.

Arthrobotrys oligospora, the nematode-trapping fungus, was found in higher population in the rhizosphere of soybean than in nonrhizosphere soil.

1621. PETERSON, J. L., and R. F. STRELECKI. 1965. The effect of variants of *Diaporthe phaseolorum* on soybean germination and growth in New Jersey. Plant Dis. Reptr. 49:228–229.

Low seed germination has been a problem in New Jersey-grown soybeans. Low-germinating seed lots varied in quality, some having moldy and fissured beans while others appeared to be of good quality. *Diaporthe phaseolorum* was directly associated with low germination in these lots. This fungus was found to cause production of weak and stunted seedlings and lesions on expanded cotyledons of emerging seedlings. Several morphological variants of *D. phaseolorum* were isolated from seed; the most common group resembled var. *sojae,* the cause of pod and stem blight, while a smaller group resembled *D. phaseolorum* var. *caulivora,* the cause of stem canker. Efforts to show certain of these isolates to be var. *caulivora* by using inoculation experiments were negative. Stem canker, however, occurred experimentally under New Jersey field conditions when soybeans were inoculated with known *caulivora* isolates.

1622. PETHYBRIDGE, G. H. 1926. Fungus and allied diseases of crops, 1922–1924. Min. Agr. Misc. Pub. 52: 1–97.

Bacillus lathyri was isolated from soybeans.

1623. PETRAK, F., and H. SYDOW. 1936. A small contribution to the knowledge of the fungus flora of Japan [in German]. Ann. Mycol. 34:237–251.

Taxonomic description in Latin and German of the new species *Phomopsis glycines* Petrak. Specimen from Kyoto, Japan.

1624. PETTY, M. A. 1935. The identification of certain viruses affecting leguminous plants. J. Agr. Res. 51: 1017–1039.

Soybean mosaic differs from other viruses in the host range specific to soybean. Enation pea mosaic (pea virus 1) also can infect soybean in inoculation tests.

1625. PETTY, M. A. 1943. Soybean disease incidence in Maryland in 1942 and 1943. Plant Dis. Reptr. 27: 347–349.

Reports occurrence of *Cercospora daizu* (= *C. sojina*), *C. kikuchii, Peronospora manshurica, Diaporthe sojae* (= *D. phaseolorum* var. *sojae*), *Septoria glycines, Alternaria* sp., wilt caused by *Fusarium* spp., Rhizoctonia damping-off, *Sclerotium bataticola* (= *Macrophomina phaseolina*), *Pseudomonas glycinea, Xanthomonas phaseoli* var. *sojense,* mosaic virus, potassium deficiency, and sun scald.

1626. PETTY, M. A. 1944. Soybean diseases on the eastern shore of Maryland. Bull. State Bd. Agr. Delaware 33(5):58–62.

Seed samples of 1943 crop showed injury from purple seed spot and white encrustations of downy mildew. In the field, bacterial pustule, downy mildew, charcoal rot, frog-eye, and mosaic were prevalent. Results of seed treatment were inconclusive.

1627. PEYTON, G. A., and C. C. BOWEN. 1963. The host-parasite interface of *Peronospora manshurica* on *Glycine max.* Amer. J. Bot. 50:787–797.

The fine structure of the vegetative intercellular hyphae, intracellular haustoria, and invaded host cells is described. Perinuclear Golgi apparatus and extensive lomasomes are characteristic of the hyphae and haustoria of this fungus. The invading haustoria do not penetrate the plasma membrane of the host. Except for a sheath near the point of penetration, there is no evidence of true host wall around the haustorium. However, a zone of apposition with staining properties different from those of normal host cell wall, forms around the haustorial wall between the host and parasite plasma membranes. Special modifications of the host cytoplasm in the vicinity of haustoria are described, including formation of secretory bodies and their apparent discharge through the host plasma membrane into the zone of apposition. This phenomenon, together with an apparent increase in number of ribosomes in the host, suggests highly specific reactions of the host cytoplasm to the invading haustorium.

1628. PHILLIPS, D. V., and J. P. ROSS. 1968. Incidence of brown stem rot of soybeans in North Carolina. Plant Dis. Reptr. 52:895–896.

Although reliability of diagnosing brown stem rot on the basis of internal stem discoloration may be jeopardized by the presence of the other factors causing similar symptoms, namely Fusarium wilt, the high incidence (79%) of fields with plants showing symptoms in 1966 suggests that brown stem rot has been present in North Carolina for many years.

1629. PHILLIPS, D. V., and K. R. BARKER. 1969. Responses in growth and yield of soybeans to several population levels and combinations of certain nematodes. J. Nematol. 1:23. (Abstr.)

Growth and yield of Lee soybeans were compared in small plots treated with nematicides and in nontreated

plots naturally infested with different nematode species combinations at various population levels. The nematicides used were nemagon, furadan, and temik. Growth and yield were significantly less in nontreated plots than in treated plots at four of five locations. At three locations on sandy loam soils, control varied, depending on composition of the nematode populations and type of nematicide. In test 1, nontreated plots yielded 15% less than the highest-yielding treatment (temik) where initial populations of *Pratylenchus brachyurus, P. zeae, Tylenchorhynchus claytoni* were low and where *Meloidogyne incognita* was moderate. In test 2, nontreated plots yielded 44% less than the highest-yielding treatment (furadan) where initial populations of *M. incognita, P. brachyurus, P. zeae, Belonolaimus longicaudatus* were low and *Helicotylenchus dihystera* and *Trichodorus christiei* were moderate. In test 3, nontreated plots yielded 78% less than the highest-yielding treatment (nemagon) where initial population of *T. christiei* was low, *H. dihystera* was moderate, and *Heterodera glycines* was high. Average yield of nontreated plots at these three locations was 32%, 36%, and 37% less than the average yield of plots treated with nemagon, furadan, and temik, respectively.

At two locations on loamy fine sand, results were as follows: in test 4, nontreated plots yielded 3% less than the highest-yielding treatment (nemagon) where initial populations of *T. claytoni, H. dihystera, T. christiei* were low and *H. glycines* was moderate. In test 5, nontreated plots yielded 16% less than the highest-yielding treatment (nemagon) where initial populations of *P. brachyurus, P. zeae, T. claytoni, T. christiei* were low, and *H. dihystera* and *B. longicaudatus* were high. Average yield of nontreated plots at these two locations was equal to average yield of plots treated with furadan and temik, but 10% less than average yield of plots treated with nemagon. In addition to *M. incognita* and *H. glycines,* an analysis of yield and nematode population data indicates that *Pratylenchus* spp., *B. longicaudatus,* and *T. claytoni* are contributing to substantial yield reductions in soybeans in North Carolina.

1630. PHILLIPS, D. V. 1970. Brown stem rot of soybeans in Georgia. Phytopathology 60:586. (Abstr.)

Soybean cultivars Lee, Bragg, Hampton, and Coker 102 growing in duplicate microplots were inoculated with four isolates of *Cephalosporium gregatum* by the basal stem puncture method. Brown stem rot symptoms developed in 97% of the inoculated plants and in 3% of the controls. There were no significant differences among cultivars or isolates in the percentage of plants with brown stem rot symptoms; however, there were differences among isolates in the extent of symptom development. Two isolates caused extensive internal browning (83 and 84% of the stem length) in all four cultivars. During mid-October 1969, plants from 73 fields in 25 counties were examined for brown stem rot symptoms. Internal browning was found in plants from 86% of the fields sampled, and *C. gregatum* was isolated from 40% of the samples with internal browning. *C. gregatum* was isolated from plants in all major soybean production areas of the state. Since *C. gregatum* appears widespread and brown stem rot developed extensively in these studies, the disease should be considered a potential threat to soybean production in Georgia and the southeast.

1631. PHILLIPS, D. V. 1970. Effect of temperature on brown stem rot of soybean. Phytopathology 60:1307. (Abstr.)

Brown stem rot (BSR) symptom development was studied in field plots and in growth chambers at 15, 21, 27, and 32 C. Several soybean cultivars (maturity groups IV through VIII) were inoculated with different isolates of *Cephalosporium gregatum* (from North Carolina, Illinois, Iowa, and Mexico) by the basal stem puncture method. BSR symptom ratings were made 21–30 days after inoculation in growth chambers and just before maturity in field plots. In five experiments the symptom ratings (max. rating = 4.0) for all inoculated plants were 3.0, 2.8, 3.1, and 0.5 at 15, 21, 27, and 32 C, respectively. Symptom ratings were lower at 32 C than at lower temperatures for all combinations of soybean cultivars and *C. gregatum* isolates tested. In field plots, internal browning averaged 50% of the stem length for all inoculated plants. Air temperature recorded near the field plots from June 1 to November 1 indicated that temperatures were above 32 C for 4%, 27–32 C for 22%, 15–27 C for 63%, and below 15 C for 11% of the growing season. Since BSR symptoms developed extensively between 15 and 27 C and were not completely inhibited at 32 C, temperatures occurring during the growing season probably do not limit disease development where soybeans in maturity groups IV through VIII are grown.

1632. PHILLIPS, D. V. 1970. Incidence of brown stem rot of soybean in Georgia. Plant Dis. Reptr. 54:987–988.

The 25 counties sampled include 73% of Georgia counties with 5,000 or more acres of soybeans and account for nearly 60% of the Georgia soybean acreage. Brown stem rot (BSR) symptoms were found in all but one county sampled and *Cephalosporium gregatum* was isolated from soybeans in 14 counties. BSR symptoms were observed in an average of 49% of the plants in 63 of the 73 fields sampled.

1633. PHILLIPS, D. V. 1971. A disease of soybean caused by *Neocosmospora vasinfecta.* Phytopathology 61:906. (Abstr.)

An abstract of entry 1635.

1634. PHILLIPS, D. V. 1971. Influence of air tempera-

ture on brown stem rot of soybean. Phytopathology 61: 1205–1208.

The influence of air temperature on brown stem rot (BSR) of soybean was determined, using several soybean cultivars inoculated with different isolates of *Cephalosporium gregatum.* Maximum BSR symptom development occurred at 15–27 C. Symptom development, rated on a scale of 0–4, was 3 at 27 C, 2 at 30 C, and 1 at 32 C. Cultivars were about equally susceptible to BSR, but *C. gregatum* isolates differed in virulence. Influence of temperature was the same regardless of cultivar or isolate. Air temperatures in field microplots were high enough to seriously limit BSR development for only a minor part of the growing season, and BSR development in these plots was extensive. Thus, air temperatures may have little influence on BSR development in the field.

1635. PHILLIPS, D. V. 1972. A soybean disease caused by *Neocosmospora vasinfecta.* Phytopathology 62:612–615.

Neocosmospora vasinfecta was isolated from several soybean plants with discoloration in the pith and xylem of the stem. Soybean plants inoculated with *N. vasinfecta* developed internal stem discoloration. The fungus was reisolated. Single ascospore isolates were used in subsequent pathogenicity tests. Fifteen soybean cultivars were susceptible. Symptom expression was greater at 27 C than at 21 or 15 C. Stem puncture inoculations resulted in a much higher percentage of diseased plants than did inoculation of injured roots. The length of internal stem browning in greenhouse-grown plants 4 to 7 weeks after inoculation did not exceed 13 cm. In field-grown plants inoculated in June and examined in October, internal browning extended a maximum of 47 cm above the inoculation point. *N. vasinfecta* had little effect on plant height and did not kill the soybean plant. Internal stem discoloration caused by *N. vasinfecta* in soybean plants is similar to that of brown stem rot caused by *Cephalosporium gregatum,* but *N. vasinfecta* hyphae are confined to the pith whereas *C. gregatum* hyphae are found primarily in the xylem of young plants. *N. vasinfecta* caused similar symptoms in cultivars of *Phaseolus vulgaris* and *Vigna sinensis,* but not in 11 other crop plants.

1636. PHILLIPS, D. V. 1972. Influence of photoperiod on brown stem rot of soybean. Phytopathology 62:782. (Abstr.)

Plants of Lee soybean of different age and developmental stage were obtained by varying planting date and length of photoperiod. Plants were inoculated with *Cephalosporium gregatum* and symptom ratings, based on length of internal stem browning, were made 28 days later. Brown stem rot symptom ratings were lower in young than in old vegetative plants. After floral induction, symptom ratings were similar, regardless of age. An increase in symptom rating occurred when young plants were changed from a long-day to a short-day photoperiod. Plants exposed to a short-day photoperiod with a light-interrupted dark period responded similarly to those exposed to a long-day photoperiod.

1637. PHILLIPS, D. V. 1972. Influence of photoperiod, plant age, and stage of development on brown stem rot of soybeans. Phytopathology 62:1334–1337.

Brown stem rot symptom ratings were lower in young vegetative soybean plants than in older vegetative plants. Age did not influence symptom development in plants after floral induction. An increase in symptom rating occurred when young plants were changed from a long-day to a short-day photoperiod. Whether this response was associated with floral induction or was an independent response to change in photoperiod was not determined.

1638. PHILLIPS, D. V. 1973. The relationship of floral induction to brown stem rot of soybean. Phytopathology 63:447. (Abstr.)

Young soybean plants inoculated with *Cephalosporium gregatum* and exposed to photoperiods which induce flowering (short days) have higher brown stem rot symptom ratings than similar plants exposed to long-day photoperiods. The increase in disease rating could be associated directly with floral induction or could be an independent response to length of photoperiod. Inoculated soybean plants were exposed to various combinations of long days (12 hr. photoperiod with a light-interrupted dark period) and short days (12 hr. photoperiod). Disease ratings were made 28 days after inoculation. All plants exposed to short days flowered. Maximum disease ratings occurred in plants exposed to many long days after exposure to short days, or in plants not exposed to short days. Thus, in plants exposed to short days and then to a sufficient number of long days, floral induction occurred without an increase in disease rating. Apparently the increase in disease rating resulting from exposure to short days is not associated directly with floral induction.

1639. PHILLIPS, D. V. 1973. Variations in *Phialophora gregata.* Plant Dis. Reptr. 57:1063–1065.

A collection of *Phialophora gregata* mass isolates and monoconidial isolates varied extensively in cultural type, but less extensively in virulence or growth rate. The extent of internal stem discoloration in inoculated soybean plants was used to identify at least three virulence types. All isolates required an exogenous source of biotin and thiamine.

1640. PIERCE, W. H. 1934. Viroses of the bean. Phytopathology 24:87–115.

Yellow bean mosaic virus and lucerne mosaic virus infected soybean upon sap inoculation.

1641. PIERCE, W. H. 1935. The identification of cer-

tain viruses affecting leguminous plants. J. Agr. Res. 51: 1017–1039.

Soybean mosaic virus appeared to be specific to soybeans as no infection on other leguminous plants occurred. Pea virus 1 infected soybeans. The article primarily deals with the identification of viruses affecting leguminous plants, based on symptom expression on differential hosts, varietal susceptibility, and host range.

1642. PIETKIEWICZ, T. A. 1959. Some observations on the microflora of soybean seeds [in Polish, English summary]. Rocz. Nauk Rolnicz. Ser. A- Roslinna 79: 1077–1090.

From various parts of Poland, 162 samples of soybean seed to be used for breeding and planting were found to be contaminated by a number of fungi and bacteria: *Fusarium martii* var. *minus, F. anguioides, F. poae* f.1, and *Botrytis cinerea* were found frequently, and caused seedling diseases and seed decay. They could not be eliminated by seed disinfection. *Peronospora manshurica* caused milky-white spots on the seed coat. Other micro-organisms associated with soybean seeds were *Penicillium* spp., *Alternaria* spp., *Trichothecium roseum, Rhizopus nigricans, Mucor* spp., *Aspergillus* sp., *Ascochyta* sp., and nonidentified bacteria.

1643. PINCKARD, J. A. 1942. Diseases of soybeans and peanuts in Mississippi. Plant Dis. Reptr. 26:472–473.

Records the occurrence and prevalence of *Bacterium* (= *Xanthomonas*) *phaseoli* var. *sojense, Peronospora manshurica, Sclerotium rolfsii, Cercospora* sp., and mosaic virus.

1644. PIPER, C. V., and W. J. MORSE. 1923. The soybean. McGraw-Hill, New York and London. 329 pp.

Two different nematodes cause injury to roots of soybeans and reduce the crop considerably. Root knot caused by the nematode *Heterodera radicicola* often causes considerable injury to soybeans in many southern states where this pest is prevalent. In areas where the pest has become well established, only resistant cultivars should be planted. Planting susceptible cultivars is dangerous, not only because the bean crop will be reduced but also because the pest can reproduce freely and greatly damage susceptible crops that follow soybeans. Laredo and three other unnamed cultivars are resistant to both the nematode and wilt.

1645. PISANO, M. A. 1963. Activities of the *Cephalosporia.* Trans. New York Acad. Sci. 25:716–730.

A review article indicating that *Cephalosporium gregatum* infects soybean, causing brown stem rot.

1646. PITRE, H. N., R. H. PLUENNEKE, K. M. BHIRUD, and S. E. PALMER. 1972. Dimethyl sulfoxide (DMSO): influence on bean pod mottle disease and interaction with disulfoton and phorate. J. Econ. Entomol. 65:1195–1197.

Soybean seeds soaked in dimethyl sulfoxide (DMSO) were not affected in their ability to germinate or produce a stand. The severity of bean pod mottle (BPM) disease was not affected by DMSO; however, plants from seeds treated with DMSO appeared to have a higher incidence of disease. Yields were approximately the same for treatments within cultivars. There was no consistent effect of DMSO on BPM disease severity when DMSO was applied immediately prior to inoculation of soybean plants. There was an 8% lower BPM disease incidence on plants treated with DMSO. Plants inoculated at the fifth trifoliolate stage were not affected by DMSO, while plants in the seventh trifoliolate stage showed 25% more infected plants for DMSO treatments. There was an overall reduction in disease incidence with each subsequent inoculation as expected due to the increased ability of plants to withstand infection with maturity. Yield data also reflected the apparent lack of effect of DMSO on plant damage due to BPMV. Phorate and disulfoton + DMSO treatments were more toxic to *Dalbulas maidis* during the 4- and 8-hr. feeding periods on sorghum and corn than were the insecticide treatments without DMSO. Phorate + DMSO, and carbofuran treated plants showed similar toxicity through day 14 to insects fed for 4 hr. on sorghum. Carbofuran was, in general, the most effective of the insecticides against *D. maidis.*

1647. Plant pathology. Rpt. Sec. Agr. Rhodesia, Oct. 1968–Sept. 1969. 29 pp.

Purple stain (*Cercospora kikuchii*) of soybean was common in Rhodesia.

1648. PLURAD, S. B., and D. M. DAUGHERTY. 1970. Growth parameters of *Nematospora coryli* Peglion (Ascomycetaceae) and progress of infection in inoculated soybeans. Trans. Missouri Acad. Sci. 4:125–134.

Yeast-spot disease of soybeans is caused by the pathogenic yeast *Nematospora coryli.* The disease is transmitted by several species of insects. In vitro experiments showed that *Nematospora coryli* and *Saccharomyces cerevisiae ellipsoideus* possess similar pH optimums (pH 6), although the latter can tolerate a more acid medium. The optimum, minimum, and maximum temperature requirements of *N. coryli* were 30 C, 15 C, 40 C, respectively, when the organism was grown in nutrient broth. No growth was observed at 10 C and 45 C. The organism survived freezing at −30 C up to 14 days, longest observation time. *N. coryli* can apparently synthesize all the vitamins required for growth after incubation for 48 hr. in a vitamin-free yeast base. Soybean seeds inoculated with *N. coryli* showed approximately a two-fold increase in number of yeast cells recovered; this increase continued up to 7 days. Young, succulent soybean pods and seeds were most susceptible to the pathogen and

early infection resulted in premature death and dehiscence of pods or stunting and wrinkling of seeds. Inoculation in more mature seeds showed characteristic lesions and wrinkling. Senescence was delayed in the infected plant, coupled with certain abnormalities such as formation of adventitious buds.

1649. PLURAD, S. B. 1972. Fine structure of ascosporogenesis in *Nematospora coryli* Peglion, a pathogenic yeast. J. Bact. 109:927–929.

Observations with the electron microscope of the early stages of ascospore formation in *Nematospora coryli* reveal the following sequence of events: Partial dissociation of the nuclear membrane is followed by the appearance of unit membranes. Each unit membrane gives rise to two pairs of double membranes delimiting the ascospores from the epiplasm of the ascus. Enlarged mitochondria, which have a granular matrix and limited crustae development, also are regularly seen.

1650. POH, T. W., G. S. LAN, and L. Y. CHUAN. 1972. Studies on groundnut mosaic virus of *Arachis hypogaea* L. in West Malaysia. Experimental Agr. 8: 355–368.

A previously undescribed mosaic disease was observed on groundnut, causing mottling and other leaf symptoms. *Aphis craccivora* is the principal vector. A soybean field adjacent to an infected groundnut field was naturally infected. The leaves showed puckering and distortion.

1651. POLANCO and CASANOVA. 1966. [*Cercospora kikuchii* on soybean, a new pathogen in Venezuela.] 6th Agron. Conf., Maracaibo, March 1966. Rpt. Vol. III. Caracas, Venezuela.

Symptoms of disease and morphology of the fungus are described.

1652. PORTER, R. H. 1926. A preliminary report of surveys for plant diseases in East China. Plant Dis. Reptr. Suppl. 46:153–166.

Soybean mosaic is the most common disease in China. Estimated losses are about 6%.

1653. PORTER, R. H. 1944. Soybean seed treatments. Plant Dis. Reptr. Suppl. 145:22–25.

Seed treatment with spergon, arasan, semesan, and fermate increased stand and yield of soybeans in some localities.

1654. PORTER, R. H. 1946. Induced baldhead in soybean. Phytopathology 36:168–170.

Soybean seeds planted in soils with 15% moisture content and naturally infected by *Pythium graminicola* and *P. debaryanum* produced baldhead seedlings in which the plumule was partially or wholly destroyed and necrosis of primary leaves occurred early in the growth of plumule. Axillary buds often had developed at base of the decayed plumule. Seed treatment with arasan, spergon, or fermate reduced the infection.

1655. PORTER, R. H. 1946. Vegetable soybean seed treatments. Plant Dis. Reptr. Suppl. 161:42–44.

Results of tests in 1944 using Banzei soybean with a high vitality show significant increase in emergenee from seeds treated with fermate, spergon, or arasan in 5 out of 17 locations. Spergon gave the most consistent increase.

1656. PORTER, R. H. 1946. Germinability of treated and untreated lots of vegetable seed in Pythium-infested soil and in the field. Iowa Agr. Expt. Sta. Res. Bull. 345.

The seed treatments arasan, spergon, or semesan jr. were effective as protectants for soybeans against *Pythium* spp.

1657. PORTER, R. P., and H. T. COOK. 1942. *Peronospora* on soybeans in Virginia. Plant Dis. Reptr. 26: 413.

The downy mildew was abnormally abundant in 1942, because of the abundant rainfall and moderate temperature during the latter part of August.

1658. PORTO, M. D. M., and D. J. HAGEDORN. 1973. Some characteristics of a Brazilian isolate of soybean mosaic virus. 2nd Internatl. Cong. Plant Path. Abstrs.: 0924. (Abstr.)

An isolate of soybean mosaic virus (SMV) from soybeans grown in Brazil was studied in the greenhouse at Madison, Wis. Soybean cultivars differed greatly in reaction to the isolate. Some cultivars showed no symptoms and the virus could not be recovered from them; others developed severe systemic symptoms and a significant reduction of the root system. Soil fertility influenced virus concentration. Two new hosts for SMV, *Galactia* sp. and *Glycine wightii,* developed systemic symptoms following mechanical inoculation. The virus was readily transmitted from *Phaseolus lathyroides* to soybean by aphids. This host could be an important source of inoculum under field conditions. A method for quick detection of seed infection is being developed. It was demonstrated that embryos, cotyledons, and seed coats of infected seeds can transmit the virus. [N.B.: The authors corrected their abstract to say that seed coats cannot transmit the virus.]

1659. PORTO, M. D. M., and D. J. HAGEDORN. 1974. Susceptibility of *Phaseolus lathyroides* to soybean mosaic virus. Plant Dis. Reptr. 58:322–326.

Five plant introductions of *Phaseolus lathyroides,* a potential forage plant in Brazil, proved susceptible to a Brazilian isolate of the soybean mosaic virus. Plant stunting and premature leaf abscission were common symptoms, possibly important in forage yield. Concentration of the virus was not related to severity of the disease. The virus was disseminated by aphids, not only to healthy

P. lathyroides plants, but also to soybeans. Transmission of the virus through seeds of *P. lathyroides* was not detected.

1660. POTTER, J. W., and J. A. FOX. 1965. Hybridization of *Heterodera schachtii* and *Heterodera glycines.* Phytopathology 55:800–801.

Hybridization between *Heterodera schachtii* and *H. glycines* was obtained in an attempt to study inheritance of parasitism. F_1 generation of *H. glycines* females × *H. schachtii* males was pathogenic to sugar beets but not to soybean.

1661. PRASARTSEE, C., and J. B. SINCLAIR. 1974. Soybean (*Glycine max*) pre- and postemergence damping-off, various seed- and soilborne organisms. Amer. Phytopath. Soc. Fungicide and Nematicide Tests, Results of 1973. 29:146.

Two lots of Cutler 71 soybean seeds were harvested in 1972 from Illinois fields at Le Roy and Eldorado. The Le Roy lot was considered poor quality and the Eldorado lot as good quality, based on appearance and in vitro germination of 69% and 95%, respectively. Field data showed no benefits were derived from any of the treatments on good-quality seeds. Significant differences in percentage stand were recorded among treatments when poor-quality seed were treated. Busan appeared to be phytotoxic. Greenhouse results showed a similar trend, but the data were erratic. Compounds that were consistently superior in both trials were: captan 80W, dithane M-45 SPC, SD-205 + captan 80W, and uniroyal 1109 and 1110. Busan was more phytotoxic on poor-quality than on good-quality seeds. L-205 and SD-205 when used alone were phytotoxic, but in a mixture the phytotoxicity was not as evident, which suggests that phytotoxicity may be due to changes in soil microflora or increased sensitivity to the compounds because of a damaged seed coat.

1661a. PRASARTSEE, C., and J. B. SINCLAIR. 1974. Reduction of symptoms and internally seed-borne *Diaporthe phaseolorum* var. *sojae* on soybean sprayed with fungicides. Proc. Amer. Phytopath. Soc. 1:128. (Abstr.)

Soybean plants (cultivar Cutler 71) were sprayed with benomyl, thiophanate-methyl, mancozeb, thiabendazole, DAC 2787 or benomyl + mancozeb at 70, 80, 90, and 100 days after planting, using recommended rates. Disease ratings were made 28 days after the last spray by visually estimating the intensity of pycnidia on stems. There was a significant (5% level) reduction in stem symptoms for all fungicides, with benomyl + mancozeb, thiophanate-methyl, and benomyl giving the best control in descending order. Two hundred seeds from each treatment were bioassayed for percentage internally borne *Diaporthe phaseolorum* var. *sojae* (*Dps*). Seeds from all fungicide-treated plants had significantly (5% level) lower percentage *Dps* than the controls. There was a significant (5% level) positive correlation (0.640) between disease intensity on stems and incidence of *Dps* in seeds.

1662. PRESLEY, J. T., and W. B. ALLINGTON. 1947. Brown stem rot of soybean caused by a *Cephalosporium.* Phytopathology 37:681–682.

A brief note on morphology and cultural characters of the fungus. Fungus sporulated on water agar, 2% rice polish agar, and soybean leaf juice extract agar (juice from 15–20 gm leaves). Addition of sucrose greatly inhibited or eliminated sporulation.

1663. PRESTON, D. A., and W. W. RAY. 1943. Yeast spot disease of soybean reported from Oklahoma and North Carolina. Plant Dis. Reptr. 27:601–602.

First report of yeast spot disease in the United States. The causal organism *Nematospora coryli* attacks only seeds. Affected seeds are light cream-colored and have sunken spots. The affected area of the cotyledon becomes very white in color and cheesy in texture.

1664. PRESTON, D. A. 1946. Legume diseases previously unreported from Oklahoma. Plant Dis. Reptr. 30:45–46.

Records the following pathogens on soybean: *Phomopsis sojae* (= *Diaporthe phaseolorum* var. *sojae*), *Phyllosticta glycineum* (= *P. sojaecola*), and *Sclerotium rolfsii.*

1665. PRINCE, A. E. 1944. Soybean diseases in North Carolina. Plant Dis. Reptr. 28:1008.

Records the occurrence of powdery mildew (*Erysiphe polygoni*) in the field. Cleistothecia formed on leaves. *Xanthomonas phaseoli* var. *sojense* also was present.

1666. PRINCE, A. E. 1944. Soybean diseases in North Carolina. Plant Dis. Reptr. 28:1124–1125.

Reports the occurrence of *Glomerella glycines, Diaporthe sojae* (= *D. phaseolorum* var. *sojae*), *Sclerotium rolfsii, Peronospora manshurica, Cercospora sojina, C. canescens, Phyllosticta* sp., *Xanthomonas phaseoli* var. *sojense,* and *Alternaria* sp.

1667. PRINCE, A. E. 1944. Soybean diseases in South Carolina. Plant Dis. Reptr. 28:1125.

Reports the occurrence of mosaic virus, bacterial leaf spot, and *Cercospora canescens* causing brown spot. *Macrophomina phaseoli* appeared in patches of black pycnidia on the stem. Species of *Fusarium* occurred on stems and pod.

1668. PROBST, A. H., and K. L. ATHOW. 1958. Additional studies on the inheritance of resistance to frogeye leafspot of soybeans. Phytopathology 48:414–416.

Resistance to frog-eye leaf spot in soybean cultivars Lincoln, Illini, Wabash, and experimental strain C1076 was

found to be controlled by the same gene. There was no evidence that modifying factors act on resistant genes to condition the inheritance of the intermediate reaction of the cultivars Perry and Chief. It could not be determined from these studies whether there was an intermediate gene or a modification of the gene for susceptibility.

1669. PUTTOO, B. L. 1971. Synchytrium leaf spot of soybean in Kashmir. Indian J. Mycol. Plant Path. 1:146.

Synchytrium dolichi isolated from this host has not hitherto been reported from India.

1670. QUANJER, H. M. 1938. [An account of some virus diseases of tropical plants, tobacco, cassava, soja, arachnis, musa, sugarcane, and rice.] Landbouwk. Tijdschr. Wageningen 50:324–338.

1671. QUANTZ, L. 1951. Plant protection session of the Brunswick branch of the federal biological institute at Goslar, 11–14 Oct. 1950 [in German]. Berlin Biol. Zent. f. Land-u. Forstwirt. Mitt. 70:74–79.

Study on bean (*Phaseolus vulgaris*) viruses revealed a considerable admixture of yellow mosaic virus with widespread bean mosaic virus. Yellow mosaic virus was transmitted to soybeans.

1672. QUANTZ, L. 1952. The most important virus diseases of indigenous Leguminosae [in German]. Saatgut-Wirtsch. 4(2):34–37.

Symptoms of soybean mosaic virus on soybean are described. Notes on viruses occurring on other leguminous crops also are presented.

1673. QUANTZ, L. 1956. On the demonstration of lucerne mosaic virus in Germany and Italy [in German]. Phytopath. Z. 28:83–103.

The lucerne mosaic virus was transmitted to soybean by sap inoculation and grafting.

1674. QUANTZ, L. 1961. Studies on bean common mosaic virus and soybean mosaic virus [in German, English summary]. Phytopath. Z. 43:79–101.

Thirteen plant species including *Dolichos falcatus, Hippocrepis multisiliquosa, Lotus tetragonolobus, Lupinus albus, Phaseolus lathyroides, Trigonella coerulea,* and *T. foenum graecum* proved systemically susceptible to isolate S1174 of soybean mosaic virus. Electron microscope studies revealed the presence of threadlike virus particles 748 mμ in length and 12–13 mμ in width, which were morphologically indistinguishable from those of common bean mosaic and yellow bean mosaic. Cross-protection and serological experiments indicated a relationship among these three viruses. Most cultivars of *Phaseolus vulgaris* were infected locally, but cultivar Doppelte Hollandiche Prinzeb was infected systemically. At high temperatures the virus incited a hypersensitive reaction in bean cultivar Top Crop. Thermal inactivation point of the virus is above 62 C, dilution end point is 10^{-3} but occasionally 10^{-5}, and longevity in vitro is 24 hr.

1675. QUINIONES, S. S. 1969. Soybean mosaic. Diss. Abstr. 29B:3157–3158.

Soybean mosaic was caused by a single and (or) double infection of mild and severe strains of soybean mosaic and bean pod mottle viruses. Both strains of soybean mosaic were mechanically and seed transmissible and bean pod mottle was also mechanically transmissible. The viruses differed in symptoms, physical properties, and particle morphology. Soybean mosaic virus infections caused intracellular and cytoplasmic inclusion bodies but no inclusions were seen in chloroplasts, mitochondria, or nuclei. Single or double virus infections reduced seed yield in soybean plants.

1676. QUINIONES, S. S., and J. M. DUNLEAVY. 1970. Identity of a soybean mosaic virus isolated from *Glycine max* variety Hood. Plant Dis. Reptr. 54:301–305.

Soybean mosaic virus (SMV) isolated from soybean cultivar Hood was identified by studies on host range, symptomology, physical properties, serology, electron microscopy, inclusions, and cross-protection. This strain was compared with type strain of SMV and is related.

1677. QUINIONES, S. S., and J. M. DUNLEAVY. 1971. Filiform enations in virus-infected soybeans. Phytopathology 61:763–766.

Filiform enations were produced in 4 of 14 soybean cultivars by double infections of soybean mosaic virus and bean pod mottle virus. The enations developed 3 to 5 weeks after inoculation from the midrib of the trifoliolate leaves and were 0.5–2.5 cm long, 1 mm wide at the base, and tapered at tips. Enations produced synergistically by two unrelated viruses have not been reported previously. Both viruses occur together in naturally infected soybeans in Iowa.

1678. QUINIONES, S. S., J. M. DUNLEAVY, and J. W. FISHER. 1971. Performance of three soybean varieties inoculated with soybean mosaic virus and bean pod mottle virus. Crop Sci. 11:662–664.

Soybean mosaic virus (SMV) and bean pod mottle virus (BPMV) acted synergistically in soybean. Average yield of Amsoy, Corsoy, and Wayne was reduced 18% by SMV, 10% by BPMV, and 66% by SMV + BPMV. SMV caused mottling on 92% of the seed, SMV + BPMV on 96%. Germination of seed from SMV-infected plants was reduced by 22% and from plants with both viruses 29%. SMV was transmitted in 27% of the seed from plants with SMV alone and in 39% of that from plants with both viruses.

1679. QUIROS CALVO, M. 1950. *Chaetoseptoria*

wellmanii stev., a disease of legumes [in Spanish]. Suelo Tico 4:137–139.

A leaf spot on *Glycine* sp. (seed from Cuba) and seven other legumes (seed from Venezuela and Honduras) is reported to have occurred in Costa Rica. Leaf spots are at first scattered, dark coffee-colored, and scarcely visible to naked eye, but soon develop to form more or less circular areas 1–6 mm in diameter, surrounded by a dark chestnut-brown, circular or lobed halo. They become banded alternately. Finally the centers drop out, leaving a fish-eye appearance. Pycnidia of *Chaetoseptoria wellmanii* contain curved, granulose, hyaline, filamentous conidia 96–150 × 5–6 μ.

1680. RADULESCU, E., E. DOCEA, and C. GRUMEZA. 1971. Septoriosis, a new disease of soybean crops in Rumania [in Rumanian, English summary]. Lucrari Stiintific, A 14:305–310.

Septoria glycines was observed for the first time in Rumania in 1969.

1681. RADZIWINOWICA, J. 1963. Niektore zagadnienia nicieni rodziny Heteroderidae Skarbiowicz 1947 [in Polish, English summary]. Inst. Ochrona Roslin (Poznan) 21:209–228.

Soybean is mentioned as being a host of *Heterodera glycines.*

1682. RAILLO, A. I. 1950. Fungi of the genus *Fusarium* [in Russian]. 415 pp.

This book discusses, in general, morphology, culture, and descriptions of the species. A new, simplified taxonomic system is presented. Control measures are given. Six *Fusarium* taxa are reported on soybean seed and (or) germinating seed. *F. oxysporum* is reported on the cotyledons. Localities of the reports in the U.S.S.R. are given.

1683. RAM NATH, and A. K. LAMBAT. 1971. Fungi recorded on the imported seed and other plant material in India. Indian Phytopath. 24:189–192.

Drechslera tetramera, Fusarium equiseti, F. semitectum, and *Verticillium* sp. were isolated from soybean seed imported from United States.

1684. RAMAKRISHNAN, K. 1955. Some aspects of soil fungal ecology. Proc. Indian Acad. Sci. Sect. B, 41: 110–116.

Macrophomina phaseoli Ashby was grown from bits of roots isolated from the Vandalur soils (India), but was not one of the fungi that appeared on dilution plates of soil. It seems reasonable to assume that this fungus does not exist in free soil, but inside vegetable debris which it colonizes, and remains there either as mycelium or in some resting stage.

1685. RAMAKRISHNAN, T. S. 1951. Additions to fungi of Madras — XI. Proc. Indian Acad. Sci. Sect. B, 34:157–164.

Uromyces sojae (= *Phakopsora pachyrhizi*) on living leaves of plants grown at the agricultural research station, Palur, in 1950. Butler and Bisby (1931).

1686. RANDLES, J. W., and R. I. B. FRANCKI. 1965. Some properties of tobacco ring spot virus isolates from South Australia. Australian J. Biol. Sci. 18:979–986.

A virus has been isolated from *Gladiolus* sp., (cultivar Spic and Span) in South Australia. This gladiolus virus has been partially purified and could not be distinguished serologically from a North American strain of tobacco ring spot virus although it is symptomologically unlike the type strain. Gladiolus virus was not transmitted by the aphids *Myzus persicae, Aphis craccivora, A. gossypii, Hyperomyzus lactucae,* or *Macrosiphum euphorbiae.* The virus failed to be transmitted through soil infested with the nematode *Xiphinema americanum,* but was transmissible through seeds of soybean (cultivar Lincoln) and *Nicotiana glutinosa* L. Partially purified preparations of gladiolus virus contained polyhedral particles about 29 mμ in diameter and in the analytical ultracentrifuge showed four peaks of 21, 57, 99, and 136 S. The 21 and 57 S components were proteins whereas the 99 and 136 S components were nucleoproteins containing about 21 and 35% ribonucleic acid respectively. The molar base ratios guanine:adenine:cytosin:uracil of gladiolus virus are 23.8:22.3:22.5:31.4.

1687. RANGASWAMI, G. 1962. Bacterial plant diseases in India. Indian Agr. Res. Inst., New Delhi. 163 pp.

Discusses symptoms and briefly treats etiology, spread, and control of bacterial pustule (*Xanthomonas phaseoli sojense*).

1688. RANGASWAMI, G. 1962. Pythiaceous fungi (a review). Indian Agr. Res. Inst., New Delhi. 276 pp. 111 pp. bibliog.

1689. RAO, M. V. B., and P. N. PATEL. 1973. Studies on resistance in crops to bacterial diseases in India. V. Inheritance of resistance to bacterial pustule in soybean. Indian Phytopath. 26:564–567.

Inheritance studies in crosses between bacterial pustule resistant cultivars Lincoln, Bourke, Punjab-1, I.C. 574, PLSO-11, and Glycine-16, and susceptible cultivars Geduld and Improved Pelican revealed that resistance was governed by a single recessive gene. The importance of these findings in present and future soybean breeding programs in India is discussed.

1690. RAO, M. V. B., and P. N. PATEL. 1973. Evaluation of chemicals in vitro and in vivo against the pustule pathogen *Xanthomonas phaseoli* var. *sojense.* Indian Phytopath. 26:598–599.

Achromycin, aureomycin, and chloromycetin inhibited

growth of the bacterium in vitro. Foliar spray of plants with TF130, vitavax, and chloromycetin delayed symptom development by 7–14 days. Vitavax and chloromycetin were phytotoxic.

1691. RATTRAY, A. 1960. The soya bean in Rhodesia. Rhodesia and Nyasaland Dept. Agr. Res. and Spec. Serv., Proc. Ann. Conf. Prof. Off. 4, pp. 34–43. Also *in* Rhodesia Agr. J. 57:182.

Soybeans have suffered less from disease in the past 20 years than any of the commonly grown legumes. Bacterial blight (*Pseudomonas glycinea*) is probably the most serious and widespread. Pythium and Rhizoctonia seedling diseases occur but do little harm in the Salisbury area.

1692. REBOIS, R. V., and E. J. CAIRNS. 1968. Nematodes associated with soybeans in Alabama, Florida, and Georgia. Plant Dis. Reptr. 52:40–44.

Soil samples from soybean fields in 28 major soybean-producing counties in Alabama, northern Florida, and Georgia were examined for nematodes. Number of genera and total number of plant-parasitic nematodes recovered per pint of soil were higher in the lighter-textured soils than in the clay soils. In some instances, average soil population of certain genera varied among soybean cultivars. This is the first report of *Scutellonema brachyurum* as a parasite on soybeans.

1693. REBOIS, R. V., W. C. JOHNSON, and E. J. CAIRNS. 1968. Resistance in soybean *Glycine max* L. Merr., to the reniform nematode. Crop Sci. 8:394–395.

Of eight soybean cultivars tested, Pickett and Dyer were resistant to the reniform nematode, *Rotylenchulus reniformis.* On Pickett and Dyer, soil counts of reniform nematodes were reduced from an initial 10,000 larvae to less than 500 per pot over a 2.5-mo. period. Cultivars resistant to root-knot nematodes, *Meloidogyne* spp., were not resistant to the reniform nematode, but those resistant to the soybean-cyst nematode, *Heterodera glycines,* were resistant to the reniform nematode. Under the conditions of the test, seed yields of Pickett increased whereas those of Hood decreased when inoculated with reniform nematodes.

1694. REBOIS, R. V. 1970. Effect of soil temperature and moisture on infectivity and development of *Rotylenchulus reniformis* on soybeans, *Glycine max* L. Merr. J. Parasit. 56(4):278. (Abstr.)

A soil temperature of 29.5 C was optimum for infectivity and number of mature females of *Rotylenchulus reniformis* produced. Soil held at 8.1% moisture at 29.5 C showed more females parasitizing roots than in any other moisture regime.

1695. REBOIS, R. V., J. M. EPPS, and E. E. HARTWIG. 1970. Correlation of resistance in soybeans to *Heterodera glycines* and *Rotylenchulus reniformis.* Phytopathology 60:695–700.

All *Heterodera glycines*-resistant soybean cultivars tested were also resistant to *Rotylenchulus reniformis.* Resistance to Dyer, Custer, and Pickett is derived from Peking. D66-12394, D66-12392, and two F_4 cultivars of PI90763 × Hill crosses also carry genes for resistance to both nematodes. Resistant cultivars are attacked by *R. reniformis* larvae, but female development is subsequently inhibited. Histological effects of parasitism of female *R. reniformis* on Lee soybean closely resemble those reported with *H. glycines.* The histology of susceptible and resistant soybeans to *R. reniformis* was studied. No relationship was established between *R. reniformis* and *Meloidogyne incognita* resistance in soybeans. This is the first report in which a crop has been shown to have a common genetic source of resistance to nematodes from different genera. It is also the first report showing the histology of parasitism by *R. reniformis* on soybeans.

1696. REBOIS, R. V. 1971. The effect of *Rotylenchulus reniformis* inoculum levels on yield, nitrogen, potassium, phosphorus and amino acids of seed of resistant and susceptible soyabean (*Glycine max*). J. Nematol. 3:326–327. (Abstr.)

Resistant and susceptible soybean cultivars, inoculated with *Rotylenchulus reniformis,* were grown to maturity in a greenhouse. Harvested seed were compared with those from noninfected controls for yield, N, K, P, and acid-hydrolyzable amino acids. The inoculum levels (IL) per 3.8-liter pot were as follows: 0, 5,000, and 25,000 nematodes for Bragg, Hampton 266, and Jackson; 0, 1,000, 5,000, 10,000, and 25,000 nematodes for Hood, Lee, Dyer, and Pickett. Reniform nematode-resistant cultivars, Dyer and Pickett, did not receive the 1,000 IL. Inoculum levels of 1,000 to 10,000 were considered low and the 25,000 IL as high. Treatments were replicated and applied each year for 3 years. The highest IL was applied only in the last year. Cultivars varied in growth response and tolerance to ILs of 10,000 or less. At the 10,000 IL, Hood dry seed yields decreased 19.4% while Pickett yields increased 18.1% over their respective controls. No significant changes were observed in the dry seed yields of other cultivars at low ILs. Increasing the IL to 25,000 reduced the average dry seed yields for resistant and susceptible cultivars by 33.1%. In one test, only seed from infected Hood and Jackson plants showed a decreased N content. In this same test, seed N for all cultivars at the 5,000 IL was significantly lower than the controls by an average of 2.3%. However, when 3 years' test data were averaged the seed N from all infected plants was not significantly lower than in the controls.

One year the total seed K and P was determined for all cultivars at inoculum levels of 0 to 10,000. The total K increased over the controls in Lee and Hood and was highest at 5,000 IL. When all cultivars were grouped by

nematode treatments, the average increase in K was 5.5 and 4.6% at the 5,000 and 10,000 ILs, respectively. P content of seeds varied significantly only in infected Lee, Dyer, and Pickett. Compared with noninfected controls, Lee seed contained more P at the 1,000 IL and less at the 10,000 IL. P content of Pickett and Dyer seeds was lower than the controls at the 5,000 and 1,000 ILs. When all cultivars were grouped by nematode treatments, the P content was 11.1 and 11.6% lower in the 5,000 and 10,000 ILs, respectively, than in the controls. Of the 17 amino acids analyzed, nematode infection consistently lowered the average leucine content of seeds in all cultivars receiving the 25,000 IL treatment. Amino acid analyses were not sufficiently replicated to detect significant changes. The average percentage of leucine in seeds from resistant plants was slightly less than the average decrease of 0.71% for all cultivars. The greatest soybean losses from *R. reniformis* infections were due to reduced dry seed yield and P content of seed.

1697. REBOIS, R. V., and W. C. JOHNSON. 1973. Effect of *Rotylenchulus reniformis* on yield and nitrogen, potassium, phosphorus, and amino acid content of seed of *Glycine max*. J. Nematol. 5:1–6.

Soybean cultivars varied in their response and tolerance to low initial *Rotylenchulus reniformis* populations of 10,000 nematodes per 3.8 liters of soil, but a high initial population of 25,000 consistently reduced yields on resistant and susceptible cultivars by an average of 33.1%. At the 10,000 nematode inoculum level, dry seed yields of Hood decreased while those of Pickett increased significantly. Generally, total P decreased 11.1 and 11.5% and K increased 5.9 and 4.5% in seeds harvested from plants receiving initial inoculum levels of 5,000 and 10,000 nematodes per pot, respectively. Little change in total N content in seed was noted. Leucine content of seeds from infected plants was slightly less than from noninfected plants.

1698. REBOIS, R. V. 1973. Effect of soil temperature on infectivity and development of *Rotylenchulus reniformis* on resistant and susceptible soybeans, *Glycine max*. J. Nematol. 5:10–13.

The effect of soil temperature on parasitism and development of *Rotylenchulus reniformis* on resistant (Peking and Custer) and susceptible (Hood and Lee) soybean cultivars was studied. Soil temperatures of 15, 21.5, 25, 29.5, and 36 C ± 1 C were maintained in temperature tanks in a greenhouse. *R. reniformis* developed best at 25 and 29.5 C. The female life cycle can be completed within 19 days after inoculation under favorable conditions at 29.5 C. Plant root growth was best at 21.5 C. During a 27-day period, no egg masses were present on nematodes feeding on roots grown at 15 and 36 C. Egg masses developed on Hood but not on Lee when nematodes were introduced into soil and maintained at 29.5 C for 2 days before raising the temperature to 36 C.

1699. REBOIS, R. V. 1973. Effect of soil water on infectivity and development of *Rotylenchulus reniformis* on soybeans, *Glycine max*. J. Nematol. 5:246–249.

The effect of soil water content on *Rotylenchulus reniformis* infectivity of Lee soybean roots was investigated in an autoclaved sandy clay loam. Nematodes were introduced into soil masses maintained at constant soil water levels ranging from 3.4 to 19% by weight. Seedling growth and the soil water content-water potential relationships of the soil were determined. Nematode infectivity was greatest when the soil water content was maintained just below field capacity in the 7.2 (-1/3 bar) to 13.0% (-1/7 bar) ranges. Nematode invasion of roots was reduced in the wetter 15.5 (-1/10 bar) to 19.0% (-1/20 bar) soil moisture ranges and in the dryer 3.4 (-15 bar) to 5.8% (-3/4 bar) soil moisture ranges.

1700. REDDI, D. B. (ed.). 1969. Quarterly newsletter of plant protection committee for South East Asia and Pacific region. FAO Pub. 12. 16 pp.

Pseudoperonospora manshurica is newly reported on soybean in Thailand.

1701. REICHERT, I. 1939. Palestine: diseases of field crops. Internatl. Bull. Plant Prot. (Rome) 13:204M–210M.

In this list of diseases collected and studied from 1923 to 1938, it is reported that *Sclerotium bataticola* caused black spots on the stems and a wilt, and *Uromyces sojae* (= *Phakopsora pachyrhizi*) caused a leaf rust.

1702. REIFMAN, V. G., and T. A. POLIVANOVA. 1969. [Virus diseases of soybean in Soviet Far East.] Trudy Biol-pochv. Inst. Dal-Nevost fil Sib. otd. ANSSR 1969:83–104.

Soybean mosaic virus (SMV), bean yellow mosaic, soybean (?) stunt, and tobacco ring spot virus were found on soybean. No soybean was found to be resistant. SMV was most widespread.

1703. REILLY, J. J., and W. L. KLARMAN. 1971. Induction of the soybean phytoalexin hydroxyphaseollin with fungicides. Phytopathology 61:907. (Abstr.)

An abstract of entry 1704.

1704. REILLY, J. J., and W. L. KLARMAN. 1972. The soybean phytoalexin, hydroxyphaseollin, induced by fungicides. Phytopathology 62:1113–1115.

Hypocotyls of soybeans incubated in suspensions of various fungicides contained the soybean phytoalexin, hydroxyphaseollin (HP). Fifteen of the 27 compounds tested induced detectable quantities of HP. Amounts of HP induced by 8 of these were quantitated. Suspension of maneb (1 mmole/liter) induced the most HP (22 μg HP/g fresh weight of tissue), and maximal production occurred after 48-hr. incubation. Two decomposition products of maneb, ethylenediamine and polyethylene

(thiocarbomyl) monosulfide, also induced HP. Butylamine, the nonfungi-toxic portion of the fungicide benomyl, induced HP as effectively as did benomyl. The fungitoxic portion, benzimidazole carbamic acid, methyl ester, did not induce HP.

1705. REINKING, O. A. 1918. Philippine economic plant diseases. Philipp. J. Sci. 13:165–274.

Black mildew, caused by *Trotteria venturioides,* results in chlorosis of plants. Rhizoctonia blight appearing primarily in rainy season is very severe. The disease starts from soil and moves upwards. Infected leaves first become yellow and gradually turn black and disintegrate. Downy mildew (*Peronospora manshurica*) and rust *Uromyces sojae* (= *Phakopsora pachyrhizi*) also are recorded in Philippines.

1706. REINKING, O. A. 1919. Host index of diseases of economic plants in the Philippines. Philipp. Agr. 8: 38–54.

Lists *Peronospora trifoliorum, Rhizoctonia* sp., *Sclerotium* sp., *Trotteria venturioides,* and *Uromyces sojae* (= *Phakopsora pachyrhizi*) on soybeans.

1707. REINKING, O. A. 1919. Diseases of economic plants in southern China. Philipp. Agr. 8:105–135.

Includes *Uromyces sojae* (= *Phakopsora pachyrhizi*) and *Peronospora trifoliorum* on soybean.

1708. REINKING, O. A. 1919. Plant diseases in the Philippines. Phytopathology 9:114–140.

Records *Trotteria venturioides, Rhizoctonia* sp., and *Uromyces sojae* (= *Phakopsora pachyrhizi*) on soybean.

1709. RESCONICH, E. C. 1963. Movement of tobacco necrosis virus in systemically infected soybeans. Phytopathology 53:913–916.

Heating 10-day-old soybean seedlings for 30 sec. in water at 50 C before inoculation with various strains of tobacco necrosis virus (TNV) resulted in 100% systemic infection, but only about 20% of the nonheated controls became systemically infected. Necrosis appeared on stems and on leaves, but roots and seeds, although high in virus content, appeared healthy. Inoculation of part of a leaf with a concentrated inoculum produced lesions first only on the periphery of the inoculated area. Inoculation of only one primary leaf resulted in asymmetric infection of the entire plant. Virus moved out of the inoculated leaves of plants maintained at 23 C earlier than out of those kept at 16 C. Killing the phloem of either hypocotyl or petiole of the inoculated leaf prevented movement of virus into the epicotyl. Seed transmission is unlikely because TNV is not localized in the embryos of seeds and because the virus that concentrates in the testa and in the remains of the neucellus rapidly becomes noninfective with age. Results indicate that TNV moves through the phloem of systemically infected soybean plants.

1710. REYES, G. M. 1957. Diseases of soybeans. Philippines Bur. Plant Indus., Plant Indus. Dig. Jan. 1957, p. 61.

Bean mosaic is definitely known to be seedborne. Virus-free and infected seed have been found in the same pod.

1711. REYNOLDS, G. 1972. Toughest soybean pest keeps spreading. Farm Journ. 96(6):22D.

A popular article. The possibility of further spread of the soybean-cyst nematode to midwestern United States is discussed. Some preventative measures to slow the movement are presented.

1712. RHOADS, A. S. 1944. Summary of observations on plant diseases in Florida during the emergency plant disease prevention project surveys, July 25 to December 31, 1943. Plant Dis. Reptr. Suppl. 148:262–276.

Frog-eye disease and bacterial pustule caused defoliation, and anthracnose commonly attacked the pods. Failure to secure seed production constituted the greatest drawback to soybean culture.

1712a. RIBEIRO, O. K., D. C. ERWIN, and G. A. ZENTMYER. 1974. A defined medium for growth and oospore production of several *Phytophthora* species. Proc. Amer. Phytopath. Soc. 1:23. (Abstr.)

A synthetic medium (SM) supported growth and sexual reproduction of several homothallic, heterothallic, and interspecific hybrids of *Phytophthora. P. cactorum, P. citricola, P. erythroseptica, P. heveae, P. megasperma, P. megasperma* var. *sojae* (races 1 and 2), *P. arecae, P. cambivora, P. capsici, P. cinnamomi, P. citrophthora, P. cryptogea, P. drechsleri,* and *P. palmivora* grew as well on SM as on V-8 juice agar (V8JA). All species, including the interspecific hybrids *P. palmivora* × *P. capsici* and *P. cinnamomi* × *P. drechsleri,* produced oospores on both SM and V8JA. Oospore germination was comparable to or better than that observed on V8-JA. SM contained: 4.5 g glucose; 0.1 g L-asparagine; 0.15 g KNO_3; 1.0 g KH_2PO_4; 0.5 g $MgSO_4 \cdot 7H_2O$; 0.1 g $CaCl_2$; 30 mg β-sitosterol dissolved in CH_2Cl_2; 0.1 mg thiamine; 0.02 mg $Na_2MoO_4 \cdot 2H_2O$; 0.2 mg $ZnSO_4 \cdot 7H_2O$; 0.02 mg $CuSO_4 \cdot 5H_2O$; 0.05 mg $MnSO_4 \cdot H_2O$; 0.088 mg $Na_2B_4O_7$; 0.1 mg $FeCl_3 \cdot 6H_2O$ with 0.52 mg EDTA and deionized distilled water to 1,000 ml; 17 g Difco Noble agar. The pH was adjusted to 6.2 before autoclaving. This medium appears conducive to Phytophthora studies requiring a precise medium for the evaluation of data.

1712b. RIBEIRO, O. K., G. A. ZENTMYER, and D. C. ERWIN. 1974. The effect of the duration and quality of light on oospore germination of *Phytophthora.* Proc. Amer. Phytopath. Soc. 1:23. (Abstr.)

A simple light apparatus was used to determine the effects of duration and quality of light on oospore ger-

mination of *Phytophthora cinnamomi* and *P. megasperma* var. *sojae* (races 1 and 2). A combination of Carolina Biological Supply light filters and aqueous salt solutions were used to obtain wave lengths of 450 nm, 545 nm, 650 nm, and 750 nm. Five light treatments were tested: (a) 20 days dark followed by 12 hr. light and 12 hr. dark for 10 days; (b) 20 days dark followed by 10 days continuous light; (c) 10 days dark, 10 days continuous light, 10 days dark; (d) 4 days dark, 10 days continuous light, 4 days dark, all at a light intensity of 2.0 μwcm^{-2}; and 30 days continuous light at 0.1 μwcm^{-2}. Cultures were placed under the light condition immediately following inoculation. Oospore germination was stimulated under the blue and far red filters at both light intensities. The best germination occurred with treatment (c). This system may offer a method for obtaining more consistent germination of oospores in genetic studies of these species.

1713. RICH, S., R. AMES, and J. W. ZUKEL. 1974. 1,4-Oxathiin derivatives protect plants against ozone. Plant Dis. Reptr. 58:163–164.

Beans growing in pots of soil containing 1.2 to 9.5 ppm of carboxin and other 1,4-oxathiin derivatives were protected against injury when exposed to ozone at 25 pphm for 2 hr. Potted plants of soybeans, cotton, tomato, and tobacco were also protected against ozone when growing in soil containing 9.5 ppm of carboxin.

1714. RICHARDSON, L. T. 1965. Reversal of fungitoxicity of thiram by seed and root exudates. Proc. Canad. Phytopath. Soc. 32:17. (Abstr.)

When thiram-treated seeds were planted on peptone-dextrose-agar inoculated with *Glomerella cingulata,* the test fungus grew in a zone surrounding damaged soybean seeds and along seedling roots of soybean. It is suggested that exudates from some seeds and seedling roots form a less toxic complex with thiram and also stimulate growth of the fungus. Soybean roots in contact with the fungus developed necrosis.

1715. RICHTER, H., and R. SCHNEIDER. 1953. Investigations on morphological and biological differentiation of *Rhizoctonia solani* [in German]. Phytopath. Z. 20:167–226.

In studies at the biological institute, Berlin-Dahlem, the strains were divided into 6 groups, based on ability to form hyphal anastomoses, 176 strains from 45 hosts in 24 families originating in Europe, North and South America, Asia, and Australia. There were also six morphological groups which paralleled the fusion groups except for a few aberrant strains. The characters which appeared to be common to a particular group were: width of the hyphae; color and zoning of the submerged mycelium; color, abundance, and texture of the aerial mycelium; and color and production of pseudosclerotia.

1716. RIEUF, P. 1960. Pathogenic and saprophytic organisms on plants in Morocco [in French]. Morocco Serv. de la Rech. Agron. et de l'Enseigh., Cahiers de la Rech. Agron. 9. 359 pp.

Soybean mosaic or soja virus I Smith was observed by the author at Rabat, April 1953. This was the only soybean disease listed for Morocco.

1716a. RIGGLE, J. H. 1974. Development of *Peronospora manshurica* in leaves of susceptible, intermediate, resistant, and nonhost plants. Proc. Amer. Phytopath. Soc. 1:129. (Abstr.)

A downy mildew-susceptible soybean cultivar Wayne was inoculated with *Peronospora manshurica* at 8, 9, 10, 11, 15, and 18 days after planting. A resistant isoline SL9, the intermediate-resistance cultivar Acme, and the nonhost garden bean Tendercrop were inoculated at 10 days. At intervals of 12 or 24 hr. following inoculation, portions of leaves were removed, fixed, cleared, and stained for microscopic observation. Until 48 hr. after inoculation, development of the fungus was most rapid on the oldest leaves of Wayne. From 48 hr. on, however, development on oldest leaves was much slower than on younger leaves. Thus, ultimately, the oldest leaves had the smallest lesions. Lesions produced on Acme inoculated when 10 days old were small and growth of the fungus hyphae was slow. On the resistant SL9, growth ceased at 36 hr. and few haustoria were formed. On the garden bean Tendercrop, hyphal growth was very slow from 12 to 120 hr. following inoculation. By that time most hyphae had collapsed, but growth in a few infection sites then became rapid, resulting in visible lesions at 168 hr. after inoculation. At least a few haustoria formed in leaves of all plants and they were generally present in any individual infection site having extensive hyphal growth. Rapid growth of hyphae coupled with formation of haustoria at all infection sites on the leaf was characteristic of susceptibility.

1717. RIGGLE, J. H., and J. M. DUNLEAVY. 1974. Histology of leaf infection of susceptible and resistant soybeans by *Peronospora manshurica.* Phytopathology 64:522–526.

Detached leaves of a susceptible cultivar Wayne and a resistant isoline SL9 were inoculated with conidia of *Peronospora manshurica.* After 12, 24, 36, 48, and 51 hr. the leaves were cleared, stained, and mounted on microscope slides for observation. There were no discernible differences in the formation of germ tubes, appressoria, or penetration pegs on the two cultivars. Penetration and early hyphal growth were as rapid on resistant tissue as on susceptible tissue, but by 24 hr. the hyphae had ramified farther in the susceptible leaf than in the resistant leaf. At 36 hr. the fungus in the susceptible tissue had penetrated 40% farther than in the resistant tissue, and susceptible leaf tissue had a mean of 3.1 haustoria per penetration. After 36 hr. there were 14

haustoria/mm of hyphae in the susceptible tissue, but only 2.7/mm in the resistant tissue.

1718. RIGGS, R. D., and M. L. HAMBLEN. 1962. Soybean-cyst nematode host studies in the family Leguminosae. Arkansas Agr. Expt. Sta. Rpt. Ser. 110. 18 pp.

In the Leguminosae family, 1,152 entries representing 302 species in 61 genera were inoculated with *Heterodera glycines.* Three hundred and ninety-nine entries in 23 genera were classified as susceptible, and 270 entries in 12 other genera allowed limited reproduction. Fifty-one new records were recorded.

1719. RIGGS, R. D., and M. L. HAMBLEN. 1966. Additional weed hosts of *Heterodera glycines.* Plant Dis. Reptr. 50:15–16.

Common weeds growing in the soybean-cyst nematode-infested area and other native weeds in Arkansas were tested for susceptibility to soybean-cyst nematode. Additional plant species found to be hosts were *Cardamine parviflora* var. *arenicola, Cleome serrulata, Digitalis* sp., *Geranium maculatum, Linaria canadensis, Phytolacca americana,* and *Portulaca oleracea.*

1720. RIGGS, R. D., and M. L. HAMBLEN. 1966. Further studies on the host range of the soybean-cyst nematode. Arkansas Expt. Sta. Bull. 718. 19 pp.

Heterodera glycines reproduced on 334 of 677 legumes and 62 of 280 nonlegumes tested. These represented 103 species in 17 genera of legumes and 48 species in 43 genera of nonlegumes.

1721. RIGGS, R. D. 1966. Chemical nature of soybean resistance to the soybean-cyst nematode. Arkansas Farm Res. 15(6):7.

A popular article. No consistent difference was found in amino acids present in the roots of resistant or susceptible cultivars. But alanine was considerably higher in susceptible than in resistant cultivars. Of the 28 phenolic compounds separated, five were not present in susceptible cultivars and two were in higher quantity in resistant than in susceptible cultivars.

1722. RIGGS, R. D., D. A. SLACK, and M. L. HAMBLEN. 1968. New biotype of soybean-cyst nematode. Arkansas Farm Res. 17(5):11.

A popular article. A population of the soybean-cyst nematode from near Blytheville, Ark., reproduced readily on Pickett cultivar. Other populations failed to reproduce on this cultivar. Authors concluded that a biotype was present that may be similar to the Va.-2 isolate.

1723. RIGGS, R. D., K. S. KIM, and I. GIPSON. 1973. Ultrastructural changes in Peking soybeans infected with *Heterodera glycines.* Phytopathology 63: 76–84.

Syncytia were observed in Peking soybean within 42 hr. after inoculation with larvae of *Heterodera glycines.* Fine structural observations of syncytia revealed cell wall perforations and prominent cytoplasm containing numerous plastids, and mitochondria and proliferated endoplasmic reticulum. Syncytia were beginning to degenerate and cell wall thickenings were prominent 4 days after inoculation. Seven days after inoculation, cytoplasmic organelles were no longer distinguishable. In addition, large segments of cell wall protruded into the syncytium and surrounding cells. Lipid globules were frequently observed in the degenerating syncytia. The deposition of secondary wall material, which seals off a diseased area, may be the major mechanism of resistance against *H. glycines.*

1724. RILEY, E. A. 1956. A preliminary list of plant diseases in northern Rhodesia. Commonw. Mycol. Inst., Mycol. Papers 63. 28 pp.

Pyrenochaeta sp. was causing a leaf spot in Eastern Province of Rhodesia.

1725. RILEY, E. A. 1958. Lyamungu, plant pathology. Tanganyika Dept. Agr. Ann. Rpt. 1957 (Part II), pp. 72–74.

First report of anthracnose (*Glomerella glycines*) for Tanganyika, in Tanzania.

1726. RILEY, E. A. 1960. A revised list of plant diseases in Tanganyika Territory. Commonw. Mycol. Inst., Mycol. Papers 75. 42 pp.

Reports the occurrence of leaf spots (*Ascochyta phaseolorum*) and (*Cercospora kikuchii*), anthracnose (*Glomerella glycines*), and a root disease (*Macrophomina phaseoli*).

1727. RILEY, E. A. 1960. A revised list of plant diseases in Tanganyika Territory. Commonw. Mycol. Inst., Mycol. Papers 75. 42 pp.

Reports the occurrence of leaf spots (*Ascochyta phaseolorum*) and (*Cercospora kikuchii*), anthracnose (*Glomerella glycines*), and a root disease (*Macrophomina phaseoli*).

1728. RINEHART, K., R. PANDEY, and F. ANTOSZ. 1974. The preparation and chemical nature of PA_k, a phytoalexin produced by soybean plants. Proc. Amer. Phytopath. Soc. 1:64–65. (Abstr.)

PA_k can be produced and isolated efficiently by treating with inducer sterile cotyledons of Harosoy 63 soybean plants. The inducer was produced by growing *Phytophthora megasperma* var. *sojae* race 1 on filter-sterilized Harosoy 63 soybean plant juice for 2 days at room temperature. After autoclaving, this juice was placed on a sterile, cut surface of the cotyledon and incubated in a moist petri plate for 48 hr. These cotyledons were then extracted in 0.01 MK phosphate buffer (pH 7.2) for 1 hr. in a steamer. The resulting solution was taken to dry-

ness in a flash evaporator and then extracted with dry methanol. This methanol was again taken to dryness and re-extracted twice with methanol. This final methanol solution was concentrated and chromatographed on Sephadex LH-20 in methanol. The second bright yellow band upon development was saved and precipitated from the methanol solution by addition of diethyl ether. This compound has antibiotic activity and the structure was determined using 13 C and proton nuclear magnetic resonance (NMR), and high resolution mass spectrometry. A structure for PA_k is proposed from the data.

1729. RIVERA CAMEARENA, J. E. 1964. Pathogenic and biological aspects of sting and lance nematodes. Diss. Abstr. 25(1):19.

Soybean cultivars 3734 and Jackson are poor hosts for *Belonolaimus longicaudatus* and *Hoplolaimus coronatus.*

1730. ROBBINS. R. T., and K. R. BARKER. 1971. Reproductive responses of *Belonolaimus longicaudatus* to soil type and temperature. J. Nematol. 3:328. (Abstr.)

Effects of soil type and soil temperature on reproduction of *Belonolaimus longicaudatus* were investigated under greenhouse conditions. Lee soybean and Earlibelle strawberry were used as host plants in separate experiments designed to determine the influence of soil type on the reproduction of *B. longicaudatus.* Treatments were replicated five times and included noninoculated controls and 1,000 nematodes per 20 cm pot for each of the following soils: (a) clay soil (42% sand, 24% silt, 34% clay); (b) fine sandy loam (88, 4, 8%); (c) coarse sandy loam (80, 10, 10%); (d) a 1:1 mixture of fine sandy loam and 65-mesh screened silica sand (94, 2, 4%); (e) 65-mesh-screened silica sand (100, 0, 0%); (f) beach sand (100, 0, 0%); and (g) muck. Ninety days after inoculation, nematodes were extracted by the sugar-flotation-sieving method and counted. For soybean the reproduction factors ($Population_{final}/Population_{initial}$) for muck, clay, coarse sandy loam, fine sandy loam, 1:1 mixture, beach sand and 65-mesh sand were 0.1, 0.3, 2.5, 15.9, 18.9, and 28.9, respectively. The reproduction factors on strawberry were: 0.4, 0.4, 2.8, 13.9, 27.6, and 34.6, respectively. For the temperature study, Albritton strawberry was used as the host in 20 cm pots filled with steamed Norfolk fine sandy loam. These pots were placed in 26 cm waterproof plastic pots and the space between them was filled with small gravel. Treatments included three replicates of 0, 100, and 1,000 nematodes in water baths at 15, 20, 25, and 30 C. Sixty days after inoculation, the number of nematodes per pot was determined using the sugar-flotation-sieving method of extraction. The reproduction factors were 8, 1.0, 1.0, and 10.8 for the treatments with 100 nematodes at 15, 20, 25, and 30 C, respectively. Where 1,000 nematodes were used, the reproduction factors were 4, 1.1, 1.8, and 5.6 for the temperatures in the same order as above. Thus, *B. longicaudatus* requires a sand content of 80% or greater and a rather high soil temperature for high rates of reproduction.

1731. ROBBS, C. F. 1954. [Phytopathogenic bacteria Brazil.] Agronomia Rio de Janeiro 13:265–282.

Xanthomonas phaseoli var. *sojense* is reported on soybean in Brazil.

1732. ROBERTSON, D. G. 1963. Further studies on the host range of cowpea yellow mosaic virus. Trop. Agr. (Trinidad) 40:319–324.

Inoculation of soybeans produced irregularly shaped light-green patches between the veins and sometimes the entire leaf became chlorotic. (Nigeria).

1733. ROBINSON, R. A. 1960. Notes on Kenya agriculture. VIII: Important plant diseases. East African Agr. J. 25:131–146.

Reports the occurrence of *Synchytrium dolichi* which causes brown, raised scabs on stems and pods. Control involves use of cultivars that are immune.

1734. RODRIGUEZ-KABANA, R., and H. F. YATES. 1972. Response of Bragg soybeans to commercial nematicides. Highlights Agr. Res., Agr. Expt. Sta., Auburn Univ., Auburn, Ala. 19(2):3.

1735. ROHDE, R. A., and W. R. JENKINS. 1957. Host range of a species of *Trichodorus* and its host-parasite relationship on tomato. Phytopathology 47:295–298.

The increase of *Trichodorus* on tomato was less than tenfold but it is considered a good host for this nematode. Soybeans were considered a good host and had final counts of nematodes less than tenfold of original number of nematodes added.

1736. ROSS, J. P., and C. A. BRIM. 1957. Resistance of soybeans to the soybean-cyst nematode as determined by a double row method. Plant Dis. Reptr. 41:923–924.

Approximately 2,800 selections and cultivars of soybeans were evaluated for resistance by planting the test line or cultivar adjacent to a highly susceptible cultivar in field plots. Illsoy and Peking were found resistant.

1737. ROSS, J. P. 1958. Host-parasite relationship of the soybean-cyst nematode in resistant soybean roots. Phytopathology 48:578–579.

The histological reaction of susceptible and resistant cultivars to *Heterodera glycines* was compared. After entering the root, the larvae migrated through the cortex and many cells were broken in both cultivars. In resistant cultivars no giant cells were formed. The cells in the head regions were disorganized and necrotic and no fourth-stage larvae were found. Some third-stage larvae were seen in the degenerating stage.

1738. ROSS, J. P. 1959. Influence of resistance to

Heterodera glycines on soybean yield and nematode populations. Phytopathology 49:319. (Abstr.)

The soybean-cyst nematode does not reproduce on roots of the Peking cultivar of soybean. To determine the influence of this resistance on soybean yields and nematode populations, Peking and a susceptible soybean line of similar maturity were planted in treated and nontreated infested soil. Granular nemagon broadcast at 3 gal./acre was used to treat a strip of infested soil 18 × 280 ft. 9 days before planting. Contiguous strips of treated and nontreated soil were divided into six paired blocks and the same randomization plan was used for arranging 18-ft. plots in both soils. Respective yields of susceptible and resistant plants growing in nonfumigated plots were 37 and 66% of the yields, of the same soybean lines growing in fumigated plots. In nonfumigated soil 1 mo. after planting, root nodulation was abundant on Peking and extremely sparse on the susceptible line. Nematode populations in nonfumigated plots, 2½ weeks after planting, were correlated ($r = -0.8206$) with soybean yield of the susceptible line, while there was no correlation for Peking. After maturity, the average nematode population in nonfumigated plots was 3 (range, 0–10) larvae per pint of soil for Peking and 320 (range, 20–1,100) for the susceptible line.

1739. ROSS, J. P. 1959. Interaction of *Meloidogyne incognita incognita* and *Heterodera glycines* on soybeans. Phytopathology 49:549. (Abstr.)

The interaction of *Meloidogyne incognita incognita* and *Heterodera glycines* on Lee soybeans was studied by growing plants in soils artificially infested with the nematodes singly and in combination. Methylbromide-treated Norfolk sandy loam was placed in glazed clay tiles of 2 ft. inside diameter and 3 ft. long. These microplots were infested with sufficient inoculum to allow good initial plant growth and nematode reproduction. From periodic assays, counts of *Heterodera* larvae per ½ pint of soil, alone and in combination with *Meloidogyne*, respectively, were as follows: 53 days, 3,500 and 800; 84 days, 1,400 and 9,300; 111 days, 14,300 and 28,000; 154 days, 1,700 and 1,600. The *Meloidogyne* population in the presence of *H. glycines* was suppressed in the last two-thirds of the growing season, and at 11 days it was one-third as large as the population where it existed alone. There were no apparent symptoms on the aboveground parts of the root-knot-infected plants. Symptoms of the soybean-cyst nematode disease were greatly intensified by the presence of the root-knot nematode, and this was reflected in yields (g) per plant: control, 44.6; cyst nematode 13.3; root-knot nematode, 39.5; root-knot plus cyst nematode 5.8.

1740. ROSS, J. P. 1959. Nitrogen fertilization on the response of soybeans infected with *Heterodera glycines*. Plant Dis. Reptr. 43:1284–1286.

Split applications of 40, 120, and 210 lb. N (NH_4NO_3) per acre to plots heavily infested with *Heterodera glycines* caused striking increases in soybean yield and final nematode populations. Yield increases from plots fertilized with 120 and 210 lb. N per acre were significantly greater than in nonfertilized plots. This response is attributed to stimulation of root growth which provided more multiplication sites for the nematode. N fertilization decreased soybean root nodulation.

1741. ROSS, J. P. 1960. Soybean-cyst nematode control by crop rotation. Phytopathology 50:652. (Abstr.)

An abstract of entry 1743.

1742. ROSS, J. P. 1960. The effect of soil temperature on development of *Heterodera glycines* in soybeans. Phytopathology 50:652. (Abstr.)

An abstract of entry 1750.

1743. ROSS, J. P. 1962. Crop rotation effects on the soybean-cyst nematode population and soybean yields. Phytopathology 52:815–818.

Crop rotation plots were maintained from 1956 to 1960 on land infested with *Heterodera glycines*. A 4-yr. rotation with a nonsusceptible crop prevented development of large populations of this nematode on soybeans. Although nematode populations rose to high levels on soybeans following 2 yr. of cowpeas, soybean yields were not significantly lower than those of soybeans following 3 yr. of cowpeas. Low soybean yields and reduced percentage of protein of soybean seed were correlated with high cyst nematode populations of the preceding fall. There were no differences in soybean yields or postseason nematode populations among 2-yr. rotations involving cowpeas, corn, or cotton as nonhost crops.

1744. ROSS, J. P. 1962. Physiological strains of *Heterodera glycines*. Plant Dis. Reptr. 46:766–769.

Populations of *Heterodera glycines* from North Carolina and Tennessee were compared for ability to develop on a soybean line rated resistant in Tennessee and susceptible in North Carolina and on a cultivar rated susceptible in both states. In two experiments, females of the Tennessee population rarely developed in the resistant soybean line while female development of the North Carolina population was not inhibited. On the nineteenth day after inoculation, over 50% of the Tennessee nematode population remained in the second and third stages (35% were obviously degenerate) in the roots of the resistant line, while only 14% of the nematodes from North Carolina remained in these stages of development. Female development of both populations was equal in the susceptible cultivar. These data demonstrate the existence of physiological specialization of *H. glycines*.

1745. ROSS, J. P., and T. J. SMITH. 1963. Brown stem rot of soybean in North Carolina and Virginia. Plant Dis. Reptr. 47:329.

First report of the disease in the southern United States.

1746. ROSS, J. P. 1963. Seasonal variation of larval emergence from cysts of the soybean-cyst nematode, *Heterodera glycines.* Phytopathology 53:608–609.

Near the end of soybean-growing season the rate of larvae emergence from cysts sharply decreased and reached a minimum after soybean maturity. This seasonal variation may become important when evaluating soybean progeny for resistance in greenhouse. The largest increase in larvae emergence occurred when soil temperature was low.

1747. ROSS, J. P. 1963. Transmission of bean pod mottle virus in soybeans by beetles. Plant Dis. Reptr. 47: 1049–1050.

Cerotoma trifurcata was shown to be a vector, retaining the virus for at least 2 days after acquisition feeding. *Diabrotica undecimpunctata howardii* was a transmitter in one instance.

1748. ROSS, J. P. 1963. Interaction of soybean mosaic and bean pod mottle viruses infecting soybeans. Phytopathology 53:887. (Abstr.)

In a thrice-replicated field experiment, the primary leaves of Hill and Lee soybeans were inoculated with soybean mosaic virus (SMV), bean pod mottle virus (BPMV), or both. Plants of both cultivars inoculated with the two viruses were more severely stunted than those inoculated with either alone. Yields of cultivar Lee inoculated with SMV, BPMV, or both viruses were reduced 18%, 26%, and 73%, respectively; yields of cultivar Hill similarly inoculated were reduced 43%, 14%, and 81%, respectively. The percentage of seed from virus-infected plants (SMV, BPMV, or SMV + BPMV) manifesting hilum color in the seed coat (mottling) was 2–3 times as high as that of seed from adjacent noninoculated plants. The percentage of seed transmission of SMV in cultivar Lee inoculated with SMV or SMV and BPMV was 11.1 and 6.0, respectively; seed transmission of SMV in cultivar Hill was less than 1%. Mottled seed of cultivar Lee harvested from SMV-inoculated plants gave 18.2% SMV transmission; normal-appearing seed from the same plants gave 8.2% SMV transmission. No evidence of seed transmission of BPMV was obtained.

1749. ROSS, J. P. 1964. Interaction of *Heterodera glycines* and *Meloidogyne incognita* on soybeans. Phytopathology 54:304–307.

Interaction of *Heterodera glycines* and *Meloidogyne incognita* on soybeans was studied in microplots during three seasons. Changes in population levels of each nematode infecting soybeans alone and in mixed culture were compared. Degree of inhibition of populations of *M. incognita* when both nematode species infected the plants varied indirectly with initial population level of root-knot nematodes. Cyst nematode populations were largely unaffected by low initial root-knot nematode populations, but high initial root-knot nematode populations curtailed cyst nematode reproduction during the latter part of the season. High initial cyst nematode populations were depressed early in the season in plots with moderately high initial root-knot nematode populations; later, however, cyst nematode populations were greater in plots containing both nematodes than in plots containing only *H. glycines.* Symptoms of the cyst nematode disease were intensified by moderate or high root-knot nematode infection. The combined effect of both nematodes on soybean yield reduction varied from slightly less to slightly more than additive, depending on nematode population levels. The percentage of protein in seed from plants infected with *M. incognita* was increased, whereas that from plants infected with *H. glycines* was decreased.

1750. ROSS, J. P. 1964. Effect of soil temperature on development of *Heterodera glycines* in soybean roots. Phytopathology 54:1228–1231.

Soil temperatures affected development of *Heterodera glycines* in susceptible soybean roots as follows: (1) at 10 C no development occurred; (2) between 17 and 28 C larval degeneration was infrequent and male:female ratios were < 1; (3) at 31 C or above, larval degeneration was frequent and adult male:female ratios were $>$ 1; (4) adult females developed at 32 C but not at 35 C; (5) after exposure of roots to 35 C on 3 consecutive days for 4 hr. daily, 56% of the nematodes degenerated and the male:female ratio was > 2; (6) exposure of roots shortly after infection to high temperatures for 8 hr. on each of 3 consecutive days was more deleterious to nematode development than exposures to the same temperatures for 4 hr. on each of 6 consecutive days.

1751. ROSS, J. P. 1965. Predisposition of soybeans to Fusarium wilt by *Heterodera glycines* and *Meloidogyne incognita.* Phytopathology 55:361–364.

The cultivar Jackson was severely affected by wilt in the greenhouse when grown in nonsterilized soil containing *Heterodera glycines* and oat cultures of *Fusarium oxysporum* but was not affected by wilt in soil containing either pathogen alone. Lee manifested greater foliage symptoms and vascular discoloration and yielded the wilt fungus upon isolation more frequently when grown in microplots infested with *H. glycines* and *F. oxysporum* than it did when grown in microplots infested with *Meloidogyne incognita* and *F. oxysporum* (the latter was not reisolated from plants growing in soil infested with the wilt *Fusarium* alone). Root-knot-resistant Jackson was not predisposed to wilt by *M. incognita* in microplots. Yelredo, a wilt-susceptible cultivar, died earlier in the season when grown in microplots infested with *H. glycines* and *F. oxysporum* than it did when grown in microplots infested with *F. oxysporum* alone. Significantly higher populations of *H. glycines* developed on Lee soybeans in *Fusarium*-infested soil than developed in *Fusarium*-free soil.

1752. ROSS, J. P. 1965. Nematodes increase Fusarium wilt in soybeans. Crops and Soils 17(9):25.

A popular article. Soybeans grown in soils infested with *Fusarium oxysporum* and *Heterodera glycines* or *Meloidogyne incognita* developed severe wilt symptoms. Cyst nematodes increased the susceptibility of soybeans more than root-knot nematodes toward Fusarium wilt. Cultivar differences were noted.

1753. ROSS, J. P., C. J. NUSBAUM, and H. HIRSCHMANN. 1967. Soybean yield reduction by lesion, stunt, and spiral nematodes. Phytopathology 57:463–464. (Abstr.)

The effect of spiral (*Helicotylenchus dihystera*), stunt (*Tylenchorhynchus claytoni*), and lesion (*Pratylenchus brachyurus*) nematodes on yields of Lee soybean was determined for two growing seasons in artificially infested microplots. Norfolk sandy loam in 12 glazed clay tiles of 2-ft. inside diameter and 3-ft. length was fumigated with methylbromide in spring 1965. Each nematode species was used separately to infest three plots; three plots were used as controls. Sieve-Baermann funnel nematode assays of 1-pt. soil samples near the end of 1965 and 1966 growing seasons gave 44,700 and 55,800 spiral, 26,400 and 37,000 lesion, and 4,000 and 2,000 stunt nematodes, respectively. In 1966, flotation-sieving assays gave 2.5- and 3-fold increases in stunt and spiral nematode recovery, respectively, over the sieve-Baermann funnel method. All species probably approached their population ceilings on Lee soybeans near the end of both seasons. Whereas no significant yield reductions occurred in 1965, soybean yields from plots infested with lesion, stunt, and spiral nematodes in 1966 were reduced 31.4, 21.1, and 15.7%, respectively. Populations early in the 1966 season were higher than populations early in the 1965 season and probably accounted for the greater yield reductions in 1966.

1754. ROSS, J. P. 1967. Purification of soybean mosaic virus for antiserum production. Phytopathology 57:465–467.

Soybean mosaic virus from infected soybean leaf tissue was purified sufficiently to produce antiserum free of host antibodies. The purification procedure involved grinding tissue in 0.5 M sodium citrate, precipitation of normal plant proteins with n-butanol, two differential centrifugation cycles, and density-gradient centrifugation. Resuspension of pelleted virus was greatly facilitated by 0.01 M borate buffer.

1755. ROSS, J. P. 1968. Effect of single and double infections of soybean mosaic and bean pod mottle viruses on soybean yield and seed characteristics. Plant Dis. Reptr. 52:344–348.

Yields of Hill and Lee soybeans inoculated as seedlings with soybean mosaic virus strains (SMV-1 and SMV-2) were reduced 8–25%, depending on strain of virus, location, and soybean cultivar. The percentage of mottled seed from SMV-1 inoculated plants was greater than that from plants inoculated with SMV-2; seed mottling was greatly affected by location and season. Seed quality of Hill was reduced more by SMV-1 than by SMV-2 while SMV-2 reduced seed size more than SMV-1. Lee yields and seed size and quality were reduced more by bean pod mottle virus (BPMV) than were those of Hill. Soybean seedlings inoculated with either soybean mosaic virus (SMV) strain + BPMV developed severe symptoms and synergistic yield reductions occurred (up to 80%). Synergistic responses occurred with respect to (1) seed mottling when Lee was inoculated with SMV-1 + BPMV; (2) reduction in seed size when Hill was inoculated with SMV-2 + BPMV; (3) seed quality reduction of both cultivars when inoculated with SMV-1 + BPMV.

1756. ROSS, J. P. 1968. Additional physiological races of *Cercospora sojina* on soybeans in North Carolina. Phytopathology 58:708–709.

Race 3 and race 4 of the fungus are identified. Resistant reaction of cultivars Comet and Flambeau to race 3 differentiates race 3 from race 4 which produces susceptible reactions on these cultivars. Reactions of 33 cultivars to four races under greenhouse and field conditions are tabulated.

1757. ROSS, J. P. 1969. Effect of *Heterodera glycines* on yields of non-nodulating soybeans grown at various nitrogen levels. J. Nematol. 1:40–42.

The addition of N in the form of $NaNO_3$ to plots of nonnodulating soybean infected with *Heterodera glycines* reduced yield losses when compared to nontreated infected plots. Results indicate that besides root nodulation and N fixation, *H. glycines* causes soybean yield reductions by inciting deleterious host responses that increase with N deficiency.

1758. ROSS, J. P. 1969. Pathogenic variation among isolates of soybean mosaic virus. Phytopathology 59:829–832.

Soybean mosaic virus (SMV) isolates varied significantly in their pathogenicity to 24 soybean selections. Host reactions depended on the soybean genotype and SMV strain and included no symptoms, systemic mottling, necrotic lesions on inoculated leaves, systemic necrotic lesions, and general necrosis. Plant introductions 96,983 and 170,893 and cultivar Ogden were resistant to the seven SMV isolates. These isolates also varied in pathogenicity to Rowan lespedeza, eliciting symptoms of dwarfing, straplike or diminutive leaves, shot necrosis, mild mottle, or no symptoms.

1759. ROSS, J. P. 1969. Effect of temperature on development of soybean seed coat mottling caused by soybean mosaic virus. Phytopathology 59:1047. (Abstr.)

An abstract of entry 1762.

1760. ROSS, J. P. 1969. Effect of time and sequence of inoculation of soybeans with soybean mosaic and bean pod mottle viruses on yields and seed characters. Phytopathology 59:1404–1408.

Early inoculations of Hill and Lee soybean plants with bean pod mottle virus (BPMV) and soybean mosaic virus (SMV) altered seed characters more than later inoculations. Sequential inoculations with SMV and BPMV (1 week apart) in either order generally reduced yields as much as simultaneous inoculations. Early sequential inoculations of SMV followed by BPMV significantly reduced yields more than inoculations made in the reverse order in one out of three seasons. In general, sequential inoculations of SMV followed by BPMV caused more seed mottling, greater reductions in seed size, and poorer quality than inoculations made in the reverse order. BPMV infection reduced the amount of SMV seed transmission. The earlier BPMV inoculations were made with respect to SMV seed inoculations, the greater the reduction of SMV seed transmission. Emergence of seedlings from seed of doubly infected plants was less than that from singly infected plants.

1761. ROSS, J. P., and J. A. HARPER. 1970. Effect of *Endogone* mycorrhiza on soybean yields. Phytopathology 60:1552–1556.

Growth and yield of soybean plants were increased 34–40% in the presence of the vesicular-arbuscular mycorrhizal fungus *Endogone*. Inoculum for these plots was produced by culturing *Endogone* monoxencially on soybean roots to ensure the absence of other soil microorganisms. Mycorrhizal plants accumulated greater amounts of P, N, Ca, Cu, and Mn in their foliage than nonmycorrhizal plants. Infesting previously fumigated field plots with *Endogone* resulted in yield increases of 29% over fumigated noninfested plots. This effect did not occur in nonfumigated soil.

1762. ROSS, J. P. 1970. Effect of temperature on mottling of soybean caused by soybean mosaic virus. Phytopathology 60:1798–1800.

Temperatures during flowering and especially early pod development were the most influential in affecting the development of mottling of seed from soybean mosaic virus (SMV) infected plants of moderately and highly susceptible soybean genotypes. Exposure of infected plants to 20 C during this growth period caused the greatest percentage of seed coat mottling on both genotypes, whereas, exposures to 30 C significantly reduced mottling of seed of the susceptible genotype and virtually eliminated this symptom on the moderately susceptible genotype. Nonmottled and mottled seed from SMV-infected plants transmitted the virus equally.

1763. ROSS, J. P. 1971. Effect of phosphate fertilization on yield of mycorrhizal and nonmycorrhizal soybeans. Phytopathology 61:1400–1403.

Mycorrhizal infection by *Endogone* prevented soybean yield from being related to PO_4 levels in fumigated soil. At low, medium, and high PO_4 yield increases due to *Endogone* were 122, 67, and 12%, respectively. Concentrations of N, P, Ca, and Cu in the leaves were greater in mycorrhizal plants at the various PO_4 levels. The P concentrate in leaves of mycorrhizal plants at the lowest PO_4 level was greater than that of nonmycorrhizal plants at the highest level. It is suggested that mycorrhiza may aid the plants in functions other than PO_4 uptake.

1764. ROSS, J. P. 1972. Influence of *Endogone* mycorrhiza on Phytophthora rot of soybean. Phytopathology 62:896–897.

Internal stem discoloration developed on 88% of Phytophthora rot-susceptible soybean plants growing in a sandy loam soil infested with *Phytophthora megasperma* var. *sojae* and a chlamydosporic species of *Endogone*, and 33% of the plants died. In plots infested with *Phytophthora* alone, 17% of the plants developed internal stem discoloration but none died. *Endogone* had no effect on Phytophthora rot symptoms on a more disease-tolerant cultivar.

1765. ROSS, J. P., and J. W. GILLIAM. 1973. Effect of *Endogone* mycorrhiza and phosphorus uptake by soybeans from inorganic phosphates. Proc. Soil. Sci. Soc. Amer. 37:237–239.

Seed yields of soybean mycorrhizal with *Endogone* were compared to yields from nonmycorrhizal plants in a P-deficient soil fertilized with various phosphate sources. Mycorrhizal outyielded nonmycorrhizal plants by 79, 530, 0, and 56% when fertilized with Al, Fe, rock, or monocalcium phosphate, respectively. Yields from mycorrhizal plants fertilized with Fe phosphate were one-sixth and one-fifth those fertilized with monocalcium or Al phosphate, respectively. In a selective phosphate depletion experiment, mycorrhizal and nonmycorrhizal soybeans were grown in soil from Ap horizon of a Norfolk sandy loam with dilute acid extractable P content of 70–162 ppm. Al, Fe, Ca, and reductant soluble phosphates were determined in soil samples taken at planting and 10 and 23 weeks later. Soil planted to mycorrhizal soybean contained 5 and 8 μg of AlP_2O_4/g of soil less than soil from nonmycorrhizal plots at the last two sampling dates, respectively. Mycorrhizal soybean plot soil contained 2.4 μg $Fe_2P_2O_4/g$ of soil less than nonmycorrhizal plots.

1766. ROUATT, J. W., E. A. PETERSON, H. KATZNELSON, and V. E. HENDERSON. 1963. Microorganisms in the root zone in relation to temperature. Canad. J. Microbiol. 9:227–236.

A study was made of number and kind of microorganisms in the root zone of wheat and soybeans grown in greenhouses at 55–60, 70–75, and 85–90 F. The number of bacteria in rhizosphere and rhizoplane of soybean roots

and in root-free soil increased with increasing temperature. The same relationship held for methylene-blue-reducing, glucose-fermenting, and ammoniafying bacteria and those requiring amino acids for optimal growth. Percentage of gram-negative rod-forming bacteria increased with increasing temperature but that of gram-positive and pleomorphic organisms decreased. Fungal isolations from washed root segments showed greater incidence of *Mucor, Rhizopus, Rhizoctonia,* and *Gliocladium* at high temperatures whereas species of *Fusarium* and *Cylindrocladium* were more prevalent at low temperatures. The number of soil nematodes decreased in rhizosphere. The results suggested that temperature exerts a direct effect on organisms in root zone and an indirect effect by influencing plant growth.

1767. ROWE, R. C., M. K. BUTE, and J. C. WELLS. 1973. Cylindrocladium black rot of peanuts in North Carolina — 1972. Plant Dis. Reptr. 57:387–389.

Soybeans grown in *Cylindrocladium crotalaria* infected groundnut fields were found to be infected with this fungus. All soybean and groundnut isolates of the fungus were pathogenic to both hosts.

1768. RUPPEL, E. G. 1963. Relationship of pea enation mosaic virus isolates. Diss. Abstr. 23: 1865.

All isolates of pea enation mosaic virus caused response in soybeans.

1769. RYDER, H. W., and H. W. CRITTENDEN. 1962. Interrelationship of tobacco ring spot virus and *Meloidogyne incognita acrita* in roots of soybean. Phytopathology 52:165–166. (Abstr.)

Soybean seed (cultivar Harosoy) was planted in the greenhouse in soil infested with a root-knot nematode (*Meloidogyne incognita acrita*) and also in steam-sterilized soil. A small percentage of this seed carried tobacco ring spot virus which causes soybean bud blight. Plants were grown 42 days in an environment suitable for deposition of nematode eggs in 32 days. Upon removal from the soil, plants with both the virus and the nematode in the roots had a much reduced root system which was extensively galled. Roots with the nematode alone were extensively galled but were not reduced significantly in length, compared with roots in sterilized soil. Roots of virus-infected plants were as long as roots of virus-free plants in sterilized soil. Comparisons were made microscopically of the histopathology and cytopathology of nematode-infested roots with and without virus. When the virus was present, the lysigenomata had greater clumping of nuclei, a greater number of nuclei in the vicinity of a nematode head, and a greater amount of protoplasm.

1770. RYDER, H. W., and H. W. CRITTENDEN. 1962. Interrelationships of tobacco ringspot virus and *Meloidogyne incognita acrita* in nematode resistant and susceptible soybeans. Phytopathology 52:1220. (Abstr.)

Two cultivars of soybean (Bethel and Laredo) resistant to *Meloidogyne incognita acrita* and two cultivars (Virginia and Harosoy) susceptible to this nematode were used in greenhouse and field tests. Experiments were designed to test the influence of tobacco ring spot virus (TRSV) in each soybean cultivar on its reaction to the nematode. Plants were inoculated with the virus at various ages of maturity (2, 4, 6 weeks) and were inoculated with the nematode at planting and at 2, 4, 6 weeks. Twelve combinations of the two pathogens were used as treatments of each soybean cultivar. Data were recorded on nematode penetration and maturation and the histopathology and cytopathology of nematode-invaded roots were studied. Data were recorded on size of lysigenomata and amount of protoplasm and number of nuclei within the lysigenomata. Results indicate that the presence of TRSV in any soybean cultivar did not influence the reaction of the cultivar, in any characteristics studied, to *M. incognita acrita.*

1771. SABET, K. A. 1959. Studies in the bacterial diseases of Sudan crops. III. On the occurrence, host range and taxonomy of the bacteria causing leaf blight diseases of certain leguminous plants. Ann. Appl. Biol. 47:318–331.

The author transfers *Xanthomonas phaseoli* var. *sojense* from a varietal rank to a special form so that more weight is given to pathogenic adaptation than to the minute differences in cultural and biochemical characters. Comparative studies of eight *Xanthomonas* taxa showed that the organisms were indistinguishable by the usual bacteriological procedures, and the minute differences in certain biochemical characters were of little or no diagnostic value. In cross-inoculation experiments, *Phaseolus vulgaris* and *Dolichos lablab* were susceptible. This is the first record for *D. lablab.*

1772. SACCARDO, P. A. 1917. [Notae mycologieae. Ser. XXIII. Fungi Philippinenses a ol. Prof. C. F. Baker collecti et communicati.] Atti del'Accad. Veneto-Trentino-Istriana 10:57–94.

Includes a technical description of *Trotteria venturioides* n.sp.

1773. SAFEEULLA, K. M., and C. G. SHAW. 1964. The importance of oospores in dissemination of and primary infection by Peronosporaceae. Phytopathology 54:1436. (Abstr.)

Detailed study of fresh collections and exsiccatae of *Peronospora* and *Pseudoperonospora* spp. on soybean, *Pisum sativum, Beta vulgaris,* and *Humulus lupulus* reveals that oospores are most abundant in the inflorescences of these hosts. Normally only those parts of the hosts (stems and leaves) showing obvious symptoms are collected. Conidia and conidiophores are present on these struc-

tures, but oospores are absent more often than not. The oospores that adhere to and are embedded in the seed coat are not detached during normal handling and dissemination of the seeds. These observations suggest that dissemination of infected seeds simultaneously ensures dissemination of the pathogens and that oospores may be of far greater importance in the initiation of primary infections than was previously supposed. Oospores are unknown for many Peronosporaceae, perhaps because they are rarely or never formed in the vegetative structures and have not been sought in the inflorescence.

1774. SAHARAN, G. S., and V. K. GUPTA. 1972. Pod rot and collar rot of soybean caused by *Fusarium semitectum*. Plant Dis. Reptr. 56:693–694.

Fusarium semitectum was isolated from soybean pods with dark-brown, drying symptoms. It caused 15% infection in the seed and produced water-soaked, depressed, dark-brown lesions with rifted margins on cotyledons and hypocotyls of young germinating seedlings. In inoculation tests it caused the same symptoms on healthy pods and sterilized seeds.

1775. SAHARAN, G. S., and V. K. GUPTA. 1973. Influence of *Aspergillus* on soybean seed in storage. Phytopath. Z. 78:141–146.

Eleven different fungi were isolated from healthy and diseased soybean seeds. The most predominant fungus isolated from healthy sterilized and nonsterilized seeds was *Fusarium semitectum* (15 and 16%, respectively). The diseased seeds yielded *Aspergillus flavus* (10.5 and 15.7%) as one of the predominant fungi. Seeds when inoculated with *A. niger, A. flavus, A. tamarii, A. sydowii, A. sejunctus,* and *Syncephalastrum racemosum* and stored for 180 days remained infected and all the *Aspergilli* were proved to be deleterious, and when sown showed pre- and post-emergence damping-off. The total loss of seeds when plated on PDA was 100% in *A. niger, A. flavus,* and *A. tamarii* and 50 and 84% in *A. sydowii,* and *A. sejunctus,* respectively.

1776. SAKSENA, H. K., and R. C. TRIPATHI. 1971. Myrothecium leaf spot of soybean in India. Indian J. Mycol. Plant Path. 1:75–76.

Severe infection by *Myrothecium roridum* is reported from Kanpur, with incidence reaching 20–25%.

1777. SAL'NIKOVA, A. F. 1958. On the treatment of soybean seed [in Russian]. Sel. Khoz. Amur obl. 1:33–38.

At Blagoveshchensk Agricultural Institute, seed treatment on moist filter paper with granosan, mercuran, and hexachlorobenzole controlled *Pseudomonas glycinea* and *Fusarium* spp.

1778. SAL'NIKOVA, A. F. 1958. Methods for analyzing soy seeds for diseases [in Russian]. Dal'nevost. Nauch.-Issled. Inst. Sel'sko. Khoz., Biul. Nauch.-Tekhn. Inform. 6:11–12.

Ascochyta sojaecola and *Pseudomonas glycinea* cause two of the most dangerous diseases in the Soviet Far East. *Sclerotinia libertiana* (= *Whetzelinia sclerotiorum*) and *Xanthomonas phaseoli* var. *sojense* are also listed as serious pathogens.

1779. SAMSON, R. W. 1942. Tobacco ring spot on edible soybeans in Indiana in 1941. Plant Dis. Reptr. 26:382.

A brief note on the occurrence of tobacco ring spot disease.

1780. SANCHEZ DOMINGUEZ, R., E. MARENO MARTINEZ, and M. ZENTENO ZEVADA. 1971. Studies on the storage of soybean seed of the variety Tropicana [in Spanish, English summary]. Boletin de la Sociedad Mexicana de Micologia 1971(5):47–55.

Germination of soybean decreased with increasing relative humidity and storage period. On nontreated seeds a species of *Aspergillus glaucus* group predominated among the fungi. Treatment with tecto 60 (thiabendazole) practically inhibited development of the fungus but germination of treated seed continued to decrease. Apparently fungi are not the only cause of reduced germination.

1781. SANGAWONGSE, P. 1973. A preliminary report of study on soybean rust. Thailand J. Agr. Sci. 6:165–169.

Soybean rust caused by *Phakopsora pachyrhizi* was found in several soybean-growing areas during the rainy season 1971, with damage and losses in yield ranging from 10–30% in local cultivars and complete loss of yield in some imported cultivars. No resistant cultivar was found among 57 cultivars and hybrids tested at Mai Cho Chiang Mai, but two hybrids, 64-104 and 0-38, were tolerant. Of seven fungicides and fungicide mixtures tested, only plantvax and plantvax plus benlate reduced defoliation significantly, but benlate had no appreciable effect when used alone. No fungicide increased yields. Use of fungicides in farmers' fields will not be recommended until further tests have been made.

1782. SARBHOY, A. K. 1970. Rhizosphere and seed mycoflora of soybean. Plant Sci. 2:85–87.

Six genera of Phycomycetes, four of Ascomycetes, and seven of Fungi Imperfecti were isolated from rhizosphere of soybean cultivars Clark-63, N-69, and Improved Pelican. Only three genera of Phycomycetes, three of Ascomycetes, and five of Fungi Imperfecti were found to be present in nonrhizosphere soils. Five species of *Aspergillus, Alternaria tenuis, Cladosporium herbarum, Rhizoctonia bataticola, Fusarium* spp., *Rhizopus stolonifer,* and *Curvularia lunata* were isolated from seeds of abovementioned cultivars grown in India. Resistance to disease development (?) was noted.

1783. SARBHOY, A. K., P. N. THAPLIYAL, and M. M. PAYAK. 1972. *Phakopsora pachyrhizi* on soybean in India. Sci. and Cult. 38:198.

Records the occurrence of soybean rust in India; symptoms are described.

1784. SASAKI, S. 1929. Mummy disease of black spot of soybean [in Japanese]. Ann. Agr. Expt. Sta. Gov.-Gen. Chosen 4:1–28.

Mummy disease is due to a *Phomopsis,* the imperfect stage of *Diaporthe sojae* (= *D. phaseolorum* var. *sojae*). Symptoms and morphology of the fungus are fully described. The viability of the fungus was maintained for 652 days on nutrient media.

1785. SASSER, J. N. 1952. Identification of root-knot nematodes (*Meloidogyne* spp.) by host tests. Phytopathology 42:17–18. (Abstr.)

Host range studies were conducted with the five described *Meloidogyne* species which occur in the United States. Approximately 25 agronomic crops were tested. Inoculum for each species was the progeny of a single female. Tomato seedlings, highly susceptible to all five species, were used as controls. The tomato plants received the same amount of inoculum as the test plants. Susceptibility of the test plants was determined by comparing the amount of galling on their roots with that on the tomato controls. The tests revealed that some plant species are highly resistant or immune to one or more of the root-knot species while severely attacked by the other species. Watermelons, for example, were not attacked by *M. hapla,* although severely attacked by the other species. Peanuts were not attacked by *M. incognita, M. incognita* var. *acrita,* or *M. javanica,* but were readily attacked by *M. hapla* and *M. arenaria.* Pepper seedlings were lightly attacked by *M. javanica* although they were very susceptible to the other four species. It is believed that these and similar host reactions will eventually make it possible to identify a given root-knot population by testing it against a few possible host plant species.

1786. SASSER, J. N. 1952. Identification of root-knot nematodes (*Meloidogyne* spp.) by host reactions. Plant Dis. Reptr. 36:84–86.

Host range studies were conducted with *Meloidogyne hapla, M. arenaria, M. javanica, M. incognita, M. incognita* var. *acrita* which occur in the United States. Some plant species were highly resistant or immune to one or more of the root-knot species, but may be severely attacked by the other species. Identification of these species by help of host reaction is suggested.

1787. SASSER, J. N. 1958. *Heterodera glycines,* the present situation. Proc. S-19 Workshop in Phytonematol., Univ. Tennessee, July 1957.

A general discussion of the soybean-cyst nematode and the research under way in North Carolina is given. It covers distribution, type of damage, losses, host range, and many other important facts about the nematode.

1788. SASSER, J. N., and G. UZZELL, JR. 1960. Methyl bromide fumigation of *Heterodera glycines* in North Carolina. Plant Dis. Reptr. 44:728–732.

Eradication of the soybean-cyst nematode with methyl bromide in an airtight fumigation chamber or under a polyethylene cover required the following combinations of temperature, exposure period, and dosage levels per 1,000 cu. ft.: 50 F, 2 hr., 16 lb.; 50 F, 4, 8; 60 F, 2, 8; 70 F, 2, 8; 70 F, 4, 4; 80 F, 2, 8; 80 F, 4, 4; 90 F, 4, 2. Dosages required under cover for corresponding temperature, exposure period, and dosage level combinations were comparable to those required in the chamber. There was a close correlation between the Baermann funnel and bioassay methods for determining lethal dosages.

1789. SASSER, J. N. 1963. Crop rotation, a good weapon — soybean-cyst nematode. North Carolina Res. and Farming 22(2):13.

A popular article. A serious pest of soybean, the cyst nematode, can be controlled by crop rotation. Tests show that rotation of crops that are not attacked by the nematodes reduces the population rapidly.

1790. SASSER, J. N., and G. UZZELL, JR. 1963. Influence of nonhost crops alone or in combination with a nematicide on the longevity of the soybean-cyst nematode in the soil. Phytopathology 53:625. (Abstr.)

Longevity studies of the soybean-cyst nematode in microplots planted in corn for 1, 2, 3, and 4 yr., followed by soybeans, were initiated in 1958 and continued through 1962. DD at 20 and 40 gal./acre was applied each year as a preplant treatment. Preplant split applications of DD at 40 and 80 gal./acre, as well as spring and fall applications of DD at 20 and 40 gal./acre, were applied each year to other plots and planted to corn as long as viable larvae were recovered. Continuous corn and soybean plots without fumigants were included. Population levels were greatly reduced in all plots, other than the continuous soybeans, as indicated by soil assays made three times annually. Infestation levels remained low and often were undetectable by soil assay as long as soybeans were not planted. When soybeans were planted, nematodes were detectable in all treatments except one which had been planted to corn for 4 yr. and treated with 40 gal./acre of DD each year prior to planting corn. These studies indicated that the soybean-cyst nematode survived in soil in the absence of a host crop for at least 4 yr.; and, while soil fumigants further reduced the population, apparent eradication occurred in only one treatment.

1791. SASSER, J. N., and G. UZZELL, JR. 1963. Con-

trol of the soybean-cyst nematode by crop rotation. Phytopathology 53:625. (Abstr.)

A rotation experiment initiated in 1960, to evaluate the control of soybean-cyst nematodes, involved 1- and 2-yr. rotations compared with continuous soybean in ½-acre plots. A 1-yr. rotation was included in which the plots planted to soybean, corn, or both were fumigated in spring 1960 with 80 gal./acre of DD in a split application. In 1960, average yield from nontreated plots planted to soybeans was 5.5 bu./acre compared with 25.5 bu./acre from treated plots. In 1961, average yield of soybeans following 1 yr. of corn was 17.3 bu./acre, compared with 7.4 bu./acre for continuous soybean plots. In 1961, soybeans following corn that was treated in 1960 averaged 3.80 bu./acre. In 1962, average yield of soybeans following 1 yr. of corn was 18.7 bu./acre, compared with 24.3 bu./acre for soybeans following 2 yr. of corn. Yield from plots treated in 1960 and planted to soybeans in 1960, followed by corn in 1961 and soybeans in 1962, was 18.7 bu./acre. Yield in 1962 from continuous soybean plots was 7.7 bu./acre. Nematode populations at time of planting were inversely correlated with soybean yields. These data indicated the relative effectiveness of 1- and 2-yr. rotations with a nonhost crop in controlling the soybean-cyst nematode. It was further evident that fumigation prior to planting soybeans in a 1-yr. rotation was effective for only 1 yr.

1792. SASSER, J. N., L. A. NELSON, and H. R. GARRISS. 1965. Quantitative effects of five nematode genera on growth and yield of peanuts, cotton, and soybean following granular nematicide treatments. Nematologica 12:98–99. (Abstr.)

The following nematicides were evaluated on adjacent plantings of peanut, cotton, and soybean: zinophos at 1, 2, and 4 lb.; thimet at 1 lb.; zinophos + thimet at ½ and 1 lb. each; union carbide 21149 at 8 lb.; VC 9-104 at 4 lb.; shell 7727 at 8 lb.; nellite at 1 lb.; and diazinon at 15 lb. A nontreated check was included. All nematicides were applied as granules. Soil samples for nematode counts were taken. Natural infestations of *Xiphinema americanum, Pratylenchus brachyurus, Helicotylenchus dihystera, Criconemoides rusticum,* and *Belonolaimus longicaudatus* were present but distribution of dagger and lesion nematodes in the field was primarily in replicates 1, 2, and 3 for all crops. Spiral nematode populations were highest in replicates 4, 5, and 6. Infestations of ring and sting nematode populations were more uniform.

Specific objectives of these investigations were (1) to study treatment effects on crop responses as measured by progressive growth and yield, and (2) to determine the relationship between nematode populations and kind on crop response variables (growth and yield). Certain treatment effects as well as relationships between nematode types and crop responses were not evident in the overall analysis of variance. This is believed due to pronounced variation in distribution of nematode populations across replicates. Because of this variation the six individual replicates were aggregated into two or more groups on the basis of nematode counts to further examine the treatment-crop response pattern and the correlations between crop response and nematode counts within groups. Treatments resulted in significant yield increases. Yields of soybeans, treated with 1 lb. thimet or zinophos + thimet at ½ lb. each, were significantly greater than the control. Soybean yields from plots treated with union carbide 21149, 8 lb.; VC 9-104, 4 lb.; and shell 7727, 8 lb., were significantly less than on nontreated plots. Simple correlation coefficients indicated highly significant negative correlations between dagger nematode populations and yield of soybean.

1793. SASSER, J. N., L. A. NELSON, and K. R. BARKER. 1972. Effects of *Trichodorus christiei* and *Belonolaimus longicaudatus* on growth and yield of soybean following chemical soil treatment. J. Nematol. 4: 233–234.

The effects of *Trichodorus christiei* and *Belonolaimus longicaudatus* on soybean growth and yields were studied in chemically treated and nontreated field plots. Chemicals were applied at planting as row treatments. Nematode population densities were determined before and 60 days after planting. Correlations were studied among these densities, growth indices (60 days after planting), and yields. Positive correlations were found between growth indices and yields ($r = .92^{**}$). The population densities of *T. christiei* were negatively correlated with growth indices ($r = -.40^{*}$) and yields ($r = -.51^{**}$). Population densities of *B. longicaudatus* were negatively correlated with yields only ($r = -.37^{*}$). Differences among nematicide treatments were significant for nematode population densities, growth indices, and yields. Growth indices and yields for all nematicide treatments were greater than for the nontreated controls. Chemicals, rates, and soybean yields (kg/ha) for the various treatments were: fumazone (1,2-dibromo-3-chloropropane) at 4.65 liters/ha, 1,547; carbofuran at 2.25 kg/ha, 3,089 and at 4.5 kg/ha, 3,394; prophos at 2.25 kg/ha, 2,587 and control, 937.

1794. SATHE, A. V. 1972. Identity and nomenclature of soybean rust from India. Current Sci. 41:264–265.

On the basis of comparison of material from India with holotypes of soybean rusts kept at the natural history museum in Stockholm, it is proposed that the pathogen be called *Phakopsora pachyrhizi* instead of *Uredo sojae* or other synonyms.

1795. SATO, A., and H. KOMORI. 1964. Research on *Heterodera glycines* [in Japanese]. Soc. Plant Prot. N. Japan Ann. Rpt. 15, pp. 139–141.

P.I. 84751 and three Japanese cultivars were studied.

1796. SATO, K., and T. SHOJI. 1959. Sclerotial root-rot of coniferous seedlings caused by *Sclerotium bataticola* Taub. [in Japanese, English summary]. Meguro (Tokyo) Govt. Forest Expt. Sta. Bull. 111, pp. 51–72.

One of the isolates used for inoculation studies was taken from soybeans affected by charcoal rot (*Macrophomina phaseoli*). Some of the experiments conducted were on growth of the fungus on different media and showing temperature ranges and effect of relative humidity, influence of pH, effect of soil moisture, and toxicity of fungicides.

1797. SATTAR, A. 1952. Connection of *Rhizoctonia bataticola* (Taub) Butler, the causal fungus of root rot of cotton, and some other isolates of *R. bataticola* with the pycnidial stage of *Macrophomina phaseoli* (Maubl.) Ashby. Pakistan J. Sci. Res. 4:31–35.

Isolates of *Rhizoctonia bataticola* from cotton, tobacco, chillies, citrus, and sesamum were inoculated onto soybean and eight other plant crops. All became infected and all of the isolates produced sclerotia on these hosts except sesamum, where both sclerotia and pycnidia were produced. The pycnidial stage was identified as *Macrophomina phaseoli.* Soybeans were susceptible when inoculated.

1798. SAVULESCU, T., C. SANDU-VILLE, T. RAYSS, and A. V. ALEXANDRI. 1935. Phytosanitary conditions in Rumania during the year 1933–34 [in Rumanian and French]. Inst. Cerc. Agron. Romaniei Publ. 24:1–59.

Records the occurrence of mosaic on soybean.

1799. SAVULESCU, T., C. SANDU-VILLE, A. ARONESCU, and A. V. ALEXANDRI. 1936. Phytosanitary conditions in Rumania during the year 1934–35 [in Rumanian and French]. Inst. Cerc. Agron. Romaniei Publ. 25:1–97.

Soybeans suffered important losses from three forms of viral diseases, leaf curl, brown mosaic, and yellow mosaic. Leaf curl, which was least common, was characterized by dwarfing of plants and crumpling of leaves which were asymmetrical, irregularly shaped and protuberant on the upper surface, and rolled at margins. Brown mosaic appeared as brown, angular spots along the veins or irregularly scattered over the entire lamina. Yellow mosaic caused yellow discoloration along the veins with leaves having a marbled appearance; general chlorosis was sometimes present. From all three forms the only organism isolated was yellow mosaic virus.

1800. SAVULESCU, T., A. ARONESCU, C. SANDU-VILLE, and A. V. ALEXANDRI. 1937. Phytosanitary conditions in Rumania during the year 1935–36 [in Rumanian and French]. Inst. Cerc. Agron. Romaniei Publ. 38:1–70.

A virus disease was found on soybean, characterized by curling of the leaves and by brown or yellow mosaic, the last-named form being most widespread. In cultivar tests to yellow mosaic, the cultivar Ossyeck was moderately resistant.

1801. SAVULESCU, T. 1948. Mildew of soybean [in French]. Bucharest Acad. Romana Sect. Sti. Bull. 3: 493–498.

Investigations of soybean diseases in Rumania have shown that seed-transmitted virus diseases reduce yield from 1,000–1,500 kg/ha to 300–400 kg. *Peronospora manshurica* was observed on all the local cultivars. Two applications of 2% bordeaux mixture, one just before flowering and the other 9–12 days later, gave good control, provided the leaf surface was thoroughly wetted.

1802. SAWADA, K. 1919. Descriptive catalogue of the Formosan fungi. Part 1 [in Japanese]. Agr. Expt. Sta. Govt. Formosa Spec. Bull. 19, pp. 1–695.

Includes descriptions of the following fungi on soybean: *Hypochnus centrifugus, H. sasakii, Sclerotinia libertiana* (= *Whetzelinia sclerotiorum*).

1803. SAWADA, K. 1922. Descriptive catalogue of the Formosan fungi. Part 2 [in Japanese]. Agr. Govt. Res. Inst. Formosa Rpt. 2, pp. 1–173.

Includes a description of *Peronospora manshurica* on soybean.

1804. SAWADA, K. 1928. Descriptive catalogue of the Formosan fungi. Part 4 [in Japanese]. Dept. Agr. Res. Inst. Formosa Rpt. 33, pp. 1–123.

Includes descriptions of *Colletotrichum glycines* (= *C. dematium* f. *truncata*) and *Phakopsora sojae* (= *P. pachyrhizi*) n.comb. on soybean.

1805. SAWADA, K. 1931. Materials of the Formosan fungi [in Japanese]. Trans. Formosa Nat. Hist. Soc. 21: 227–235.

Mycological notes on *Phakopsora sojae* (= *P. pachyrhizi*) n.comb.

1806. SAWADA, K. 1933. Descriptive catalogue of the Formosan fungi. Part VI. [in Japanese]. Dept. Agr. Res. Inst. Formosa Rpt. 61, p. 117.

Phakopsora sojae (= *P. pachyrhizi*) is illustrated and described. *Uredo sojae* is reduced to synonym of *P. sojae*.

1807. SAWADA, K. 1958. Researches on fungi in the Tohoku District of Japan. IV. Fungi Imperfecti [in Japanese]. Tokyo Govt. For. Expt. Sta. Meguro, Bull. 105, pp. 35–140.

Short notes on fungi parasitic on soybean: *Ascochyta phaseolorum, Colletotrichum glycines, Phyllosticta sojaecola,* and *Septoria glycines.*

1808. SAWADA, K. 1959. Descriptive catalogue of Taiwan (Formosan) fungi. Part XI. Natl. Taiwan Univ. (Taipei) Coll. Agr. Spec. Bull. 8. 268 pp.

Notes the occurrence of *Cercospora canescens* and *Peronospora manshurica* on leaves. Taxonomic descriptions are given of: *Ascochyta phaseolorum* on leaves; *A. sojae* (syn. *A. glycine*) on petioles; *Cercospora kikuchii* on leaves, stems, and pods; *Guignardia sojae* (a new species without a Latin diagnosis) lesion girdling stems; *Mycosphaerella sojae* on leaves; *Phyllosticta glycineum* on leaves; *P. sojaecola* on leaves; *Pleosphaerulina glycines* (a new species but no Latin diagnosis) on leaves.

1809. SAYRE, R. M., and W. B. MOUNTAIN. 1962. The bulb and stem nematode (*Ditylenchus dipsaci*) on onion in southwestern Ontario. Phytopathology 52:510–516.

Soybean was classed as imune to *Ditylenchus dipsaci.*

1810. SCHEETZ, R. W., and H. W. CRITTENDEN. 1966. Histochemistry of soybean varieties resistant or susceptible to *Meloidogyne incognita acrita.* Phytopathology 56:586. (Abstr.)

Three cultivars of soybeans varying in reaction to the root-knot nematode *Meloidogyne incognita acrita* were used: Delmar (resistant) and Adams and Virginia (susceptible). They were grown in the greenhouse in soil infested with the nematode. Infected roots 30 days old were quickly frozen, sectioned in a cryostat, stained with Sudan IV, and photographed. This dye stained the peripheral lining of the lysigenomata a dark orange-red in the susceptible cultivars, whereas the same area was stained a light orange-red in the resistant cultivar. Other infected roots were fixed in formal-Ca, stained with osmium tetroxide, sectioned in a cryostat, and photographed. The peripheral lining of the lysigenomata was a darker black in the susceptible cultivars than in the resistant cultivar. Thus, within the lysigenomata there was a higher concentration of lipids in the susceptible cultivars than in the resistant cultivar.

1811. SCHENCK, N. C., and K. HINSON. 1971. Endotrophic vesicular-arbuscular mycorrhizae on soybean in Florida. Mycologia 63:672–674.

Vesicular-arbuscular (V-A) mycorrhizal fungi were isolated from soils of soybean fields in Florida and from soybean roots. Such fungi were less abundant around soybean roots growing in organic or low, poorly drained soils than in sandy well-drained soils. Most soybean roots had more than one V-A mycorrhizal fungus associated with them. Zygospores of *Endogone calospora* and *E. giganta* were most common. *Sclerocystis coremoides* also was found associated with soybean roots.

1812. SCHENCK, N. C., and K. HINSON. 1973. Response of nodulating and non-nodulating soybeans to the species *Endogone mycorrhiza.* Agron. J. 65:849–850.

Inoculation of nodulating and nonnodulating Hardee soybean isolines resulted in significant increase in seed yield and other traits in nodulating isolines but not in nonnodulating isolines. Indirect evidence showed that *Endogone* sp. did not significantly increase N absorption in nonnodulating isolines.

1813. SCHENCK, N. C., and R. A. KINLOCH. 1974. Pathogenic fungi, parasitic nematodes, and endomycorrhizal fungi associated with soybean roots in Florida. Plant Dis. Reptr. 58:169–173.

In a 1971 and 1972 survey of soybean roots and rhizosphere soil from 40 locations in northern Florida, *Fusarium* spp. were the most common pathogenic fungi recovered, followed by *Rhizoctonia* spp., *Pythium* spp., and *Macrophomina phaseolina.* Spiral nematodes were the most common parasitic nematodes, followed by stubby root, lesion, and root-knot nematodes. Spores of endomycorrhizal fungi occurred in every sample, and *Endogone calospora* was the most prevalent. Incidence of *Pythium* spp. was increased and endomycorrhizal fungi decreased by root-knot nematodes.

1814. SCHENCK, N. C., R. A. KINLOCH, and D. W. DICKSON. 1974. Interaction of endomycorrhizal fungi and root knot nematode of soybean. Proc. Amer. Phytopath. Soc. 1:69. (Abstr.)

Three endomycorrhizal fungi (*Endogone calospora, E. heterogama, E. macrocarpa*) were combined individually with *Meloidogyne incognita* on two *M. incognita* susceptible cultivars (Pickett, Ransom) and one resistant (Forrest) cultivar. The experiment was performed in 15-cm pots with five replicates per treatment in greenhouses at Jay and Gainesville, Fla. At Jay, *M. incognita* juveniles from field soil were used as nematode inoculum (0, 500, 5,000/pot) on cultivar Ransom; at Gainesville, *M. incognita* eggs from galled tomatoes were used as inoculum (0, 1,000, or 5,000/pot) on Pickett and Forrest. Just prior to planting, steamed soil with nematode inoculum was added to two-thirds of each pot. The remaining one-third was filled with steamed soil containing 25 mycorrhizal spores or, as a control, spore washwater only. After 110 days, lowest seed yields and root weights occurred on plants with high nematode populations and no mycorrhiza. Nematode populations were generally greater on mycorrhizal plants than nonmycorrhizal plants. However, in some instances nematode populations were contained by specific mycorrhizal fungi. Maximum seed yield and root weight occurred on Pickett and Ransom with *E. macrocarpa* while nematode populations remained low. On Forrest, a similar effect was obtained by *E. heterogama.* Thus, some species of mycorrhizal fungi can contain nematode populations but the fungi having this effect varied with soybean cultivars.

1815. SCHENCK, N. C., and V. N. SCHRODER. 1974. Temperature response of *Endogone* mycorrhiza on soybean roots. Mycologia 66:600–605.

Growth of an *Endogone* sp. on soybean roots was evaluated in autoclaved soil maintained at temperatures ranging from 17–41 C. Maximum arbuscular development of *Endogone* in the root occurred near 30 C and mycelial development on the root surface was greatest between 28 and 34 C. Spores/50 ml of soil and echinulate vesicle clusters/55 cm of root were most numerous at 35 C. Root growth after 60 days without *Endogone* mycorrhiza was less than that with *Endogone,* but shoot development was similar for both. No plant growth occurred at 41 C. The affinity of this species of *Endogone* for high temperatures correlated well with its abundance in the rhizosphere of summer crops rather than crops grown at other seasons of the year.

1816. SCHERFF, R. H. 1971. Inhibition of bacterial blight of soybean by *Bdellovibrio bacteriovorus.* Phytopathology 61:1025. (Abstr.)

An abstract of entry 1818.

1817. SCHERFF, R. H. 1972. Interaction of *Pseudomonas glycinea* and yellow bacteria in development of bacterial blight of soybean. Phytopathology 62:787. (Abstr.)

A group of yellow bacteria was isolated from bacterial blight-infected leaves of Clark 63 soybeans. These bacteria were small, gram negative rods, highly motile, and oxidase positive. They possessed polar flagella and produced a light-yellow, water-insoluble pigment. When *Pseudomonas glycinea* was mixed with yellow bacteria isolate YB-3 at a 1:9 ratio and immediately rubbed onto carborundum-dusted soybean leaves, lesion development of bacterial blight was inhibited. At a ratio of 1:4 a 50% reduction resulted and at a 1:1 ratio there was only slight lesion development. The initial cell concentration was 10^8 cells/ml. By incubating the *P. glycinea*-YB-3 mixture 24–48 hr. prior to inoculation, nearly complete lesions inhibition resulted with the 1:4 and 1:9 ratios; there was no reduction of symptoms at the 1:1 ratio. Population levels of *P. glycinea* and YB-3 were assayed 1, 2, 3, 7, and 14 days after careful atomizing of bacteria onto soybean leaves so as not to injure the leaf surface. At the 1:9 ratio of *P. glycinea* to YB-3, a sharp reduction in number of *P. glycinea* cells resulted after day 7; whereas in the 1:1 ratio or *P. glycinea* alone, the number of *P. glycinea* cells continued to increase.

1818. SCHERFF, R. H. 1973. Control of bacterial blight of soybean by *Bdellovibrio bacteriovorus.* Phytopathology 63:400–402.

Bdellovibrio bacteriovorus, a small, comma-shaped bacterium parasitic on other gram negative bacteria, was isolated from the rhizosphere of soybean roots. *B. bacteriovorus* isolate Bd 17 inhibited development of local and systemic symptoms of bacterial blight when inoculated onto soybean with *Pseudomonas glycinea* at ratios of 9:1 and 99:1, respectively. Two other *B. bacteriovorus* isolates were less effective in inhibiting bacterial blight. The ability of *B. bacteriovorus* to inhibit bacterial blight was correlated with the average cell burst size of the particular isolate.

1819. SCHERFF, R. H. 1973. Bacterial blight of soybeans as influenced by populations of yellow bacteria on leaves and buds. Phytopathology 63:752–755.

A bacterium characteristic of a group of yellow bacteria was isolated from soybean leaves infected with *Pseudomonas glycinea* and designated as YB-3. It is a small, gram negative rod that has polar flagella, is highly motile, oxidase positive, and produces a light-yellow, water-insoluble pigment. When *P. glycinea* was mixed with YB-3 at a 1:9 ratio and inoculated onto soybean leaves, lesion development of bacterial blight was inhibited; at a 1:4 ratio there was no reduction in symptoms, and at a 1:1 ratio there was no reduction in lesion development. By incubating the 1:4 mixture of *P. glycinea*:YB-3 for 24–48 hr. before inoculating the leaves, complete inhibition of bacterial blight symptoms resulted. Population levels of *P. glycinea* and YB-3 were assayed 1, 2, 3, 7, and 14 days after atomizing mixtures of them onto uninjured leaf surfaces. Seven days after application at a 1:9 ratio there was a sharp reduction in number of *P. glycinea* cells, whereas at a 1:1 ratio or when *P. glycinea* alone was applied, the number of *P. glycinea* cells increased. Numbers of YB-3 increased slightly through day 3 but dropped sharply thereafter. When mixtures of *P. glycinea* and YB-3 at 1:9 ratio were placed on soybean buds, YB-3 multiplied more rapidly than did *P. glycinea.* From day 3 through the remainder of the test period, the numbers of YB-3 cells remained constant but *P. glycinea* cells decreased.

1820. SCHILKE, P. J., and H. W. CRITTENDEN. 1959. Host-parasite relationships of soybean and a root-knot nematode *Meloidogyne hapla.* Phytopathology 49: 525. (Abstr.)

Three cultivars of soybeans (Laredo, Anderson, and Adams) were exposed to *Meloidogyne hapla* for periods of 7, 14, 21, 28, 35, 42, 49, and 56 days. Galls first appeared on Adams at 7 days and on Laredo and Anderson at 14 days. Egg masses were first found on Anderson and Adams at 35 days and on Laredo at 42 days. Studies of osmic-acid-stained roots showed a large number of larvae in the roots of Adams and a lesser number in the roots of Laredo and Anderson. In roots invaded by the larvae of *M. hapla,* growth of the apical meristem often ceased and 2–10 lateral roots arose from the gall. Larvae were found in the apical meristem and in the region of elongation and often were located at the junction of lateral roots. Measurements of galls showed that most of the hypertrophy occurred in the tissues of the stele. No differences were observed in the giant cells of the three cultivars. Characteristics of the giant cells

were: dense cytoplasm, thick cell walls, and enlarged nuclei.

1821. SCHINDLER, A. F. 1954. Root galling associated with dagger nematode, *Xiphinema diversicaudatum* (Micoletsky, 1927) Thorne, 1939. Phytopathology 44: 389. (Abstr.)

In a survey of nematode diseases of greenhouse-grown roses in northeastern United States it was found that galling of the rose roots was associated with infections of the dagger nematode, *Xiphinema diversicaudatum*, and not due to root-knot nematodes, *Meloidogyne* spp. This galling is characteristically an enlargement of the tip and curling of the end of the root with an apparent necrosis and shriveling of the proximal portion. This curly-tip effect appears to be typical and may be recognized with experience. By inoculating a rose cutting with 945 dagger nematodes, galls were produced experimentally on the roots. Two controls, one a cutting inoculated with water in which the nematodes were collected, the other a nontreated cutting, developed no galls on the roots. Galls or curly-tips also have been produced on roots of seedlings of tomato, soybean, okra, cucumber, balsam, and peanut grown in *X. diversicaudatum*-infested soil. In soybean, these nematodes were observed and photographed in the process of seeding upon the roots.

1822. SCHINDLER, A. F. 1957. Parasitism and pathogenicity of *Xiphinema diversicaudatum*, an ectoparasitic nematode. Nematologica 2:25–31.

Xiphinema diversicaudatum was observed apparently feeding on soybean roots, *Glycine max*, cultivar Bansei. This nematode causes curly-tip roots on hosts tested and is considered a plant parasite.

1823. SCHMITTHENNER, A. F. 1958. Root rot is still threatening state's soybean crop. Ohio Farm and Home Res. 43:58–59, 62.

A popular article describing loss caused by Phytophthora root rot (= *P. megasperma* var. *sojae*).

1824. SCHMITTHENNER, A. F., and J. W. HILTY. 1962. A method for studying postemergence seedling root rot. Phytopathology 52:177–179.

Inoculum-layer technique is described. Plastic pots were used to avoid drying-out of soil. Six cm of loose-steamed soil was placed in pot and saturated by filling the pot with water and allowing the pot to drain. A 15 cc, 7-day-old petri plate culture of *Phytophthora megasperma* var. *sojae* was removed from the dish and placed intact on the soil. The inoculum layer was covered with 2 cm of loose soil, which was watered until saturated. Soybean seeds were pressed into the surface and covered with 1 cm of loose soil. Pots were covered with white paper until the seedlings emerged, when the paper was removed and pots were watered as needed. Ten to 14 days after planting, susceptible plants were dead or severely stunted with dark-brown, vascular rot. Best medium for this technique was dilute V-8 juice agar. Also satisfactory was dilute lima-bean agar containing 20 g/liter of plain agar plus either 2.5 g/liter of Difco lima-bean agar or the extract of 5 g/liter dried lima beans, prepared by autoclaving at 15 psi for 30 min. and decanting the supernatant.

1825. SCHMITTHENNER, A. F. 1963. Phytophthora root rot, a threat to soybean production that can be eliminated. Soybean Dig. 23(1):20, 22–23.

A popular article describing symptoms and losses caused by *Phytophthora megasperma* var. *sojae*. Cultivars Harosoy 63, Hawkeye 63, Lindarin 63, and Clark 63 are described as resistant cultivars.

1826. SCHMITTHENNER, A. F. 1964. Fungi associated with root necrosis of *Phytophthora*-resistant soybeans. Phytopathology 54:906. (Abstr.)

In greenhouse tests with four lots of field soil, root damage was moderately severe on all *Phytophthora*-resistant soybean cultivars adapted to Ohio. Symptoms consisted of necrosis and collapse of small lateral roots or tips of larger roots and browning or blackening of the root cortex. *Pythium ultimum* was isolated from the majority of infected roots. *Rhizoctonia* and several species of *Fusarium* were also obtained. Using the carrot-disc technique, *Thielaviopsis* was consistently isolated from soybean roots from two of the soil lots. Soybean roots from these same soils were washed and stained in chloral hydrate-acid fuchsin and examined for fungus structures. *Thielaviopsis* chlamydospores were present on the surface of blackened roots. *Pythium* oospores and sporangia were abundant in necrotic and collapsed small lateral roots and occasionally present in the cortex of the tap root. The roots were extensively invaded with *Endogone* and also contained nematodes. In greenhouse tests, root necrosis was reduced in *Thielaviopsis*-free soils by mixing with dexon at the rate of 10 μg/g of soil. *Pythium* oospores were absent from stained roots from dexon-treated soil.

1827. SCHMITTHENNER, A. F. 1972. Evidence for a new race of *Phytophthora megasperma* var. *sojae* pathogenic to soybean. Plant Dis. Reptr. 56:536–539.

Isolates of *Phytophthora megasperma* var. *sojae* found in Ohio were pathogenically distinct from races 1 and 2 of this fungus. It is proposed that these isolates constitute a new race, designated as race 3. Soybean cultivars with Rps allele are resistant to races 1 and 2, but susceptible to race 3, with the exception of Arksoy, Lee 68, and Higan, which are resistant to all three races. Cultivars with the rps_2 allele are resistant to races 1 and 3, but susceptible to race 2. Cultivars with rps allele are susceptible to all three races. The possibility of an additional gene for resistance to *Phytophthora* in soybean is discussed.

1828. SCHMITTHENNER, A. F. 1973. New fungus race in Ohio soybeans. Ohio Rpt. on Res. and Devel. in Biol., Agr. and Home Econ. 58(1):3–4.

Distribution of race 3 of *Phytophthora megasperma* var. *sojae* was determined in field with dying soybean plants. It was isolated from 27 fields, and race 1 from 16 fields. Use of tolerant cultivar Wayne will give acceptable yields. In the field, seedlings that were not killed became increasingly resistant with age. Cultivars Amsoy and Corsoy have some tolerance.

1829. SCHNATHORST, W. C. 1954. Effects of *Sporotrichum* sp. Link on cowpea and four other leguminous hosts. Phytopathology 44:478–479.

A species of *Sporotrichum* isolated from beans was pathogenic to soybean, resulting in severe stunting.

1830. SCHNATHORST, W. C. 1954. Bacteria and fungi in seeds and plants of certified bean varieties. Phytopathology 44:588–592.

Several isolates of *Rhizoctonia solani* from *Phaseolus vulgaris* were pathogenic to soybean seeds, stems, and leaves.

1831. SCHNEIDER, R. W. 1971. Etiology of *Cephalosporium gregatum* in soybean. Master's thesis, Univ. Illinois. 25 pp.

Studies were conducted to determine (1) the method by which *Cephalosporium gregatum* spreads within soybean plants, (2) the effect of plant age at time of inoculation on symptom development, and (3) the effect of various exposure times to cool temperature (18–24 C) on symptom expression. *C. gregatum* spread to the tops of artificially and naturally inoculated soybean plants in the early pod-filling stage within 1 and 2 days, respectively. Conidial movement within the transportation stream appeared to be the only method by which such rapid spread could occur. The most extensive symptom development was observed in those plants inoculated at 6 weeks of age and in plants exposed to cool temperatures for 10 weeks. The data presented here and those of previous findings support a revised concept of the etiology of *C. gregatum* in soybean.

1832. SCHNEIDER, R. W., and J. B. SINCLAIR. 1971. Etiology of *Cephalosporium gregatum* in soybean. Phytopathology 61:909–910.

An abstract of entry 1835.

1833. SCHNEIDER, R. W., J. B. SINCLAIR, and B. L. KIRKPATRICK. 1971. Variability in growth and sporulation among five isolates of *Cephalosporium gregatum.* Phytopathology 61:1025. (Abstr.)

Differences in cultural characteristics, growth rates, and sporulation of *Cephalosporium gregatum,* incitant of brown stem rot of soybean, were compared among five isolates from Iowa (I), North Carolina (N), Illinois (L), Mexico (M), and the American Type Culture Collection (A). Isolates were grown on soybean-seed (SSA) and potato-dextrose (PDA) agars at 15, 20, 25, and 30 C for 20 days. Colonies were measured every 4 days. Colonies of M were reddish brown at all temperatures, and produced 3 or 4 concentric rings. Production of dark-brown-to-black conidia in colony centers of isolates N, I, M, and A on PDA at all temperatures after 12 and 16 days is reported for the first time. Only A produced the conidia on SSA at 25 C after 16 days. Optimum temperatures for growth on SSA were 20 C for N and L and 25 C for I, M, and A. Optimum temperatures for sporulation were 15 C for N; 20 C for I, L, and A; and 25 C for M. L produced a greater number of conidia than did all other isolates at all temperatures. There were significant differences in growth rates among the isolates within each temperature.

1834. SCHNEIDER, R. W., P. N. THAPLIYAL, and J. B. SINCLAIR. 1971. Fungi associated with soybean seed in India. Indian Phytopath. 24:792–794.

Cercospora spp., *Rhizoctonia* spp., and *Fusarium* spp., were most frequently isolated. *Pythium* sp., *Botrytis* sp., *Cladosporium* sp., *Chaetophoma* sp., *Acremonium* sp., *Diplodia* sp., *Monilia* sp., and *Tricothecium* sp. were also isolated.

1835. SCHNEIDER, R. W., J. B. SINCLAIR, and L. E. GRAY. 1972. Etiology of *Cephalosporium gregatum* in soybean. Phytopathology 62:345–349.

Cephalosporium gregatum was isolated from tap roots of soybeans within 7 weeks after planting in field plots infested with the pathogen. The fungus was detected in the tops (ninth node) of plants at the early pod-filling stage within 1 day after artificial inoculation of hypocotyls, and within 2 days after a fungal suspension was added to the nutrient solution in which the plants were growing. Conidia are apparently the principal means of spread within the plant. In greenhouse and field experiments, more stem browning developed in plants inoculated at 4–6 weeks than in those inoculated 8–12 weeks after planting. Infected plants exposed to low temperatures (18–24 C) for 4 weeks had significantly less stem browning than those exposed for 10 and 12 weeks.

1836. SCHNEIDER, R. W., O. D. DHINGRA, J. F. NICHOLSON, and J. B. SINCLAIR. 1974. *Colletotrichum truncatum* borne within the seed coat of soybean. Phytopathology 64:154–155.

Colletotrichum truncatum (= *C. dematium* f. *truncata*) was isolated from and observed within the seed coats of surface-sterilized soybean seeds, but not from embryos or cotyledons of the same seeds. The mycelium was confined to the middle hourglass layer of the seed coat and to naturally occurring wounds. *C. truncatum* also was obtained from water washings of infected soybean seed.

The seed coat symptoms of soybean seed infected with *C. truncatum* are similar to those described for *Macrophomina phaseolina.* Histochemical tests showed the hourglass layer to consist of, in part, an amorphous starch-rich matrix.

1837. SCHOEN, J. F. 1967. A modified pathological test to distinguish Phytophthora root rot resistance among soybean varieties. Proc. Assoc. Off. Seed Anal. N. Amer. 57:130–131.

A culture of *Phytophthora megasperma* var. *sojae* on 0.5% Difco lima bean agar is diluted to a consistency suitable for syringe inoculation. Seeds to be tested are germinated in moist towels at 25 C. On the fourth day a ¼-inch slit is made with the needle tip near the hypocotyl base, is kept open, and filled with inoculum from the syringe. The towels and contents are then replaced in the germinator under light and at 25 C. After 4 days an evaluation of resistance is made on the basis that susceptible cultivars show a brown, soft decay of the hypocotyl with subsequent death of the seedlings.

1838. SCHOEN, J. F. 1971. Reaction of six soybean varieties to a pathogenic isolate of *Phytophthora parasitica* from white clover. Plant Dis. Reptr. 55:130–131.

Seedlings of six soybean cultivars were inoculated in the laboratory with a pathogenic isolate of *Phytophthora parasitica.* Significant differences in the percentage of susceptible plants were found among several of the cultivars. Cultivar Bethel showed the highest average susceptibility (88.2%) and cultivar Lee the lowest (46.3%). The results indicate that inoculations employing this fungus may have limited usefulness for varietal verification.

1839. SCHROEDER, P. H., and W. R. JENKINS. 1963. Reproduction of *Pratylenchus penetrans* on root tissue grown on three media. Nematologica 9:327–331.

Experiments on rearing *Pratylenchus penetrans* on excised roots and callus on various culture media were reported. Soybean roots grew well but nematode reproduction was low.

1840. SCHROPP, W. 1938. [Beiträge zur kalimangelerscheinungen bei einigen öl- und gespinstpflanzen.] Ernähr. Pfl. 34:165–170, 181–186.

Soybeans reacted to the absence of potash by brown spotting of the foliage and inward curling of the margins, the young leaves in addition displaying an abnormally dark discoloration.

1841. SCHUCK, E. 1973. [Occurrence of bacterial disease of soybean (*Glycine max* (L) Merrill) in Rio Grande do Sul.] Agron. Sulriograndense 9:27–32.

Pseudomonas glycinea and *Xanthomonas phaseoli* var. *sojense* were recorded. All lines and cultivars tested were susceptible.

1842. SCHULTZ, H. 1950. Studies on the role of *Pythium* species as pathogens of lupine footrot. II. Results of infection experiments [in German]. Phytopath. Z. 17:200–214.

One hundred isolates of *Pythium* spp. were used on a number of plant species in Germany. Tests in the greenhouse agreed closely with those made in the field. On soybeans, *Pythium debaryanum* infection was classed as very severe; *P. irregulare* was less virulent but classed as rather severe.

1843. SCHUSTER, M. L., and D. W. CHRISTIANSEN. 1957. An orange-colored strain of *Corynebacterium flaccumfaciens* causing bean wilt. Phytopathology 47: 51–53.

Corynebacterium flaccumfaciens causing bean wilt when inoculated in soybeans produced no symptoms but was recovered 5 weeks after inoculation.

1844. SCHWARZ, M. B. 1927. Preliminary results of a crop rotation test extending over several years on rice soil in connection with investigations on slime disease (*Bacterium solanacearum*) in *Arachis hypogaea* [in Dutch, English summary]. Korte Meded. Inst. voor Plantenziekten 3. 11 pp.

Soybeans included in the rotation with groundnut were attacked by *Bacterium* (= *Pseudomonas*) *solanacearum.*

1845. SCHWENK, F. W., and T. SIM. 1974. Race 4 of *Phytophthora megasperma* var. *sojae* from soybeans proposed. Plant Dis. Reptr. 58:352–354.

Phytophthora megasperma var. *sojae* race 3 was recovered from diseased soybean from Douglas County, Nebraska. A more virulent strain, designated as race 4, was recovered from soybeans in Seddwick and Jackson counties, Kansas. Of 42 soybean lines tested, three were resistant to race 4, but have been reported susceptible to race 2.

1846. SCOTT, H. A., and R. D. RIGGS. 1971. Immunoelectrophoretic comparisons of three plant-parasitic nematodes. Phytopathology 61:751–752.

Reciprocal tests showed that two races of the soybean-cyst nematode are serologically identical and are unrelated to the birch cyst nematode. Immunoelectrophoresis of nematode extracts, when compared to gel diffusion, resulted in greater numbers of precipitin bands.

1847. SCOTT, H. A., J. V. VAN SCYOC, and C. E. VAN SCYOC. 1974. Reactions of *Glycine* spp. to bean pod mottle virus. Plant Dis. Reptr. 58:191–192.

Tests were made of 169 commercial cultivars of soybean and 123 *Glycine max* plant introductions and no resistance was found to bean pod mottle virus. Susceptible: *G. clandestine, G. garcilis, G. koidzumii,* and *G. ussuriensis.* Immune: *G. falcata, G. javanica,* and *G. tomen-*

tella. Mixed reaction: *G. wightii,* some immune, some susceptible.

1848. SEAMAN, W. L., and R. A. SHOEMAKER. 1964. *Corynespora cassiicola* on soybean in Ontario. Plant Dis. Reptr. 48:69.

Corynespora cassiicola Wei has been found sporulating on the surface of soybean roots collected from fields at Harrow, Ontario, in September 1963 and at Ottawa in October 1963.

1849. SEAMAN, W. L., R. A. SHOEMAKER, and E. A. PETERSON. 1965. Pathogenicity of *Corynespora cassiicola* on soybean. Canad. J. Bot. 43:1461–1469.

Corynespora cassiicola was pathogenic on roots and hypocotyls of soybean seedlings grown in infested soil at Ottawa. Extensive superficial necrotic lesions developed on seedlings from inoculated seeds planted in the field in mid-May, but few symptoms appeared on seedlings planted in late May and in June. Infected plants were initially stunted but recovered with little effect on size or yield. In controlled temperature studies, severe root and hypocotyl rot were produced on inoculated seedlings at 15–20 C. Symptoms were less severe at temperatures alternating from 15 or 20 C and were negligible on seedlings kept constantly at 25–35 C. Optimum growth of the fungus on agar media occurred at 20 C. At 5 C and 35 C conidia germinated, but no appreciable mycelial growth occurred; at 30 C growth was greatly restricted. Typical symptoms of target spot were produced on the inoculated foliage of soybeans in the greenhouse and in the field, but secondary infection was not observed in the field. Foliage infection occurred on cowpea, sesame, and Hartsville cotton in the greenhouse. *C. cassiicola* was isolated from overwintered soybean root debris, from the roots of mature field bean and from the roots of soybean seedlings grown in soil not previously cropped with soybeans.

1850. SEMANCICK, J. S., and J. B. BANCROFT. 1964. Further characterization of the nucleoprotein components of bean pod mottle virus. Virology 22:33–39.

Virus was grown on soybean cultivar Gibson and bean cultivar Black Valentine. Fractionated nucleoprotein components of bean pod mottle virus (BPMV) were shown to differ in base composition. The infectious bottom component (112S) displayed a guanylic acid and uridylic acid enrichment over the noninfectious middle component (91S). Sedimentation rates of extracted ribonucleic acid (RNA) suggest that the RNA deficiency of the middle particles results from the absence of a terminal or near-terminal portion of the RNA chain. A precursor-product relationship between the BPMV components could not be demonstrated by P^{32} pulse labeling.

1851. SEMENIUK, G. 1958. Three destructive foliage diseases of soybeans in South Dakota. South Dakota Farm and Home Res. 9:3–5.

A popular article describing symptoms of and losses caused by bacterial blight, bacterial pustule, and downy mildew.

1852. SERZANE, M. 1962. Plant diseases. Practical studies [in Latvian]. Riga Latvijas Valsts Izdevniecoba. 518 pp.

Contains a key to the diseases of soybeans in Latvia and taxonomic notes on *Ascochyta sojaecola, Cercospora sojina, Colletotrichum glycines* (= *C. dematium* f. *truncata*), *Fusarium, Peronospora manshurica, Pseudomonas glycinea, P. solanacearum, Sclerotinia libertiana* (= *Whetzelinia sclerotiorum*), *Septoria glycines, Uromyces sojae* (= *Phakopsora pachyrhizi*), and soybean mosaic.

1853. SHANDS, W. A., and H. W. CRITTENDEN. 1957. The influence of nitrogen and potassium on the relationship of *Meloidogyne incognita acrita* and soybeans. Phytopathology 47:454. (Abstr.)

Soybean cultivars Anderson (resistant) and Adams (susceptible) received three levels of N. Soybean cultivars Anderson, Wabash (moderately susceptible), and Adams received three levels of K. A uniform amount of inoculum of *Meloidogyne incognita acrita,* a root-knot nematode, was used in all tests. A uniform amount of a legume bacterial inoculum was incorporated into certain of the N tests and into all of the K tests. Duration of greenhouse pot tests was 42 days. Percentages of galls on Adams and Wabash were obtained. Galls were not present on Anderson; therefore, roots were stained with Flemming strong fixative to show the presence of larvae. N and K influenced the relationship of *M. incognita acrita* and soybeans; there was a general increase in penetration of Anderson and in the number of galls on Adams and Wabash with an increase of both N and K. Data from the N tests indicate that in the presence of legume bacteria the number of galls on Adams and penetration of Anderson by larvae of this nematode are increased.

1854. SHARP, C. G. 1927. Correlation of virulence and acid agglutination of a smooth and a rough strain of *Bacterium phaseoli sojense.* Phytopathology 17:49. (Abstr.)

An abstract of entry 1855.

1855. SHARP, C. G. 1927. Virulence, serological and other physiological studies of *Bacterium flaccumfaciens, Bacterium phaseoli* and *Bacterium phaseoli sojense.* Bot. Gaz. 83:113–144.

The three forms of *Bacterium* differed in morphology, physiology, and virulence, and could be differentiated by the use of the agglutination test. A smooth (S) and rough (R) strain of *B.* (= *Xanthomonas*) *phaseoli sojense* were isolated. They are identical physiologically and serologically but differed morphologically in virulence and range of acid agglutination. S strain remained

constant on media and on plants but R strain, when inoculated in plants, produced both S and R strains on reisolation. S strain is more virulent than R strain. Other physiological characters of both strains are described. *B.* (= *X.*) *phaseoli sojense* differs serologically from *B. phaseoli* (= *X. phaseoli*).

1856. SHAVROV, G. N. 1968. New species of *Paraphelenchus* (Micoletzky, 1922) Micoletzky, 1925, (Nematoda, Aphelenchidae) [in Russian]. Soobshch. dal'nevost. Fil V. L. Komarova sib. Otdel. Akad. Nauk SSSR 26:135–136.

Paraphelenchus octolineatus n.sp. females are described from around soybean in Primorsk, U.S.S.R. It resembles *P. tritici* in having no mucro but differs in the dorsally curved tail, large oval rectal bulb, and structure of the preuteral gland. The spermatheca were filled with sperm.

1857. SHAVROV, G. N. 1968. New species of plant nematode of the subfamily Acrobelinae Thorne, 1937 [in Russian]. Soobshch. dal'nevost. Fil V. L. Komarova sib. Otdel. Akad. Nauk SSSR. 26:137–140.

Females of two new species of Acrobelinae are described and figured from around soybean in Primorsk, U.S.S.R. *Chiloplacus quinilineatus* n.sp. resembles *C. propinquus* and *C. symmetricus,* but differs in the structure of cephalic and labial probolae, the "a" value, and in having five lateral lines. *Acrobeloides rectiprocerus* n.sp. is similar to *A. setosus* and *A. sexlineatus,* but differs from the former in the structure of cephalic probolae, in having a longer rectum, four lateral lines, and a smooth, rounded tail tip. It differs from *A. sexlineatus* in structure of the probolae and in number of lateral lines.

1858. SHAVROV, G. N. 1968. Study of the plant nematode fauna of soybeans in the Primorskiy Kray [in Russian]. Soobshch. dal'nevost. Fil V. L. Komarova sib. Otdel. Akad. Nauk SSSR 26:141–144.

A list of 84 nematode species associated with soybean in 13 districts in Primorsk, U.S.S.R., contains 16 species not recorded formerly in this country. Seven species new for science are named. *Heterodera glycines* was not found.

1859. SHAW, K. J. 1940. The effect of crop rotation on the control of *Heterodera marioni* on Norfolk sandy loam. Phytopathology 30:710. (Abstr.)

In a crop rotation experiment to control *Heterodera marioni,* tobacco following Laredo soybeans showed 69.8% infection.

1860. SHERWIN, H. S., C. L. LEFEBVRE, and R. W. LEUKEL. 1948. Effect of seed treatment on the germination of soybeans. Phytopathology 38:197–204.

Temperature had a marked effect on the response of several lots of soybeans to seed treatment. Increases in germination from seed treatment were obtained more often at 25 C than at any other temperature. Arasan improved emergence more frequently than either spergon or new improved ceresan. Seed obtained from Georgia, Mississippi, North Carolina, Maryland, and Virginia appeared to be benefited more by seed treatment than did seed produced in Illinois. Soybean seed treated and then stored for 1 year gave a relatively greater increase in emergence over the check than did the treated seed planted soon after treatment, but total emergence was less after storage. The moderately discolored and the nondiscolored seed lots of Wood's Extra Early Yellow soybeans showed greater response to seed treatment than did the badly discolored seed lot, when grown in the constant temperature rooms. When grown in the field, however, there were no significant differences between the reactions of the three lots of seed.

1861. SHERWIN, H. S., and K. W. KREITLOW. 1952. Discoloration of soybean seeds by the frogeye fungus, *Cercospora sojina.* Phytopathology 42:568–572.

Conspicuous discolorations designated as gray, brown, or papillate were found in seed of soybeans grown in Illinois, Louisiana, Maryland, Mississippi, and Virginia. The discolorations were caused by the frog-eye fungus *Cercospora sojina* and differed markedly from the purple stain caused by *C. kikuchii.* Surface sterilization of diseased seeds for 20 min. in 1:500 mercuric chloride in 50% ethyl alcohol failed to eliminate all of the fungus. In greenhouse and field tests, seeds discolored by *C. sojina* failed to germinate as well as clean seeds. In addition, many of the seedlings that originated from discolored seeds bore lesions on cotyledons and developed earlier infection on leaves in the field. In contrast, seeds infected with the purple stain fungus germinated normally and produced stands comparable to those from clean seeds. The seed discolorations were reproduced artificially by inoculating pods of plants growing in the greenhouse and in the field with cultures of *C. sojina* isolated from discolored seeds. In the field there was a tendency toward progressive increase in seed discoloration when plants were left standing after they matured.

1862. SHOSHIASHVILI, I. 1940. With reference to studies on soybean and groundnut diseases [in Russian]. Bull. Georgian Expt. Sta. Plant Prot. Ser. A. Phytopathology 2:271–283.

The following diseases are described from western U.S.S.R. on soybeans: *Mycosphaerella phaseolorum, Pleosphaerulina sojaecola, Phyllosticta sojaecola, Ascochyta sojaecola, Septoria sojina, Phomopsis sojae, Fusarium tracheiphilum, Fusarium* sp. causing pitting on cotyledons, and *Epicoccum neglectum.*

1863. SHUKLA, B. N., B. P. SINGH, and Y. K. SHARMA. 1974. Estimation of loss in chemical constituents of diseased seeds of soybeans (*Glycine max*). Punjabrao Krishi Vidyapeeth J. 1:225–226.

1864. SHUNK, I. V., and F. A. WOLF. 1921. Soybean bacterial blight. Phytopathology 11:52. (Abstr.)

An abstract of entry 1865.

1865. SHUNK, I. V., and F. A. WOLF. 1921. Further studies on bacterial blight of soybean. Phytopathology 11:18–24.

Bacterial blight due to *Bacterium glycineum* (= *Pseudomonas glycinea*) and *B. sojae* (= *P. glycinea*) could not be differentiated with certainty in the field. In cultures, *B. glycineum* produces pigment on certain media and forms acid from dextrose, saccharose, lactose, maltose, and glycerine, whereas *B. sojae* is nonpigment-forming and forms acid from the first two of these sugars only.

1866. SHURTLEFF, M. C. 1963. Spot and stop soybean diseases. I. The roots and stems. Crops and Soils 15(7):10–13.

A popular article giving a brief description and control measures of brown stem rot, sclerotial or southern blight, Phytophthora root and stem rot, Rhizoctonia root rot, stem canker, and pod and stem blight, root-knot, cyst-nematode, and sting nematode.

1867. SIDDIQUI, M. A. 1971. Report of senior plant pathologist, Malawi, 1969–1970. 10 pp.

New record of *Diaporthe phaseolorum* var. *sojae* on soybean in Malawi.

1868. SILBER, G., and H. E. HEGGESTAD. 1965. A strain of alfalfa mosaic virus occurring naturally on field tobacco. Phytopathology 55:1108–1113.

Alfalfa mosaic virus isolated from tobacco caused moderate yellow mottling on inoculated soybean cultivar Lincoln.

1869. SILBERSCHMIDT, K., and N. R. NOBREGA. 1942. [Notes on a virus disease of hog bean (*Canavalia ensiformis* D.C.) and another of common bean (*Phaseolus vulgaris* L.).] Biologico 8:129–133.

The virus causing Canavalia mosaic is transmissible by sap inoculation to soybean.

1870. SILVA, J. G., L. G. E. LORDELLO, and S. MIYASAKA. 1952. [Observacoes sobre a resistancia de algumas variedades de soja ao nematoide das galhas.] Bragantia 12(1/2):59–63.

Cultivars Abura, Rio Grande, 455, Chosen, Georgia, Pereira, Barreto, Arksoy, and Acadian have shown severe attacks by two forms of root-knot nematodes, both closely related to *Meloidogyne incognita*. N 46-2652, in southern United States considered a resistant cultivar, was susceptible to the above nematodes in two pot tests. In one field trial, Palmetto, La. 41-1219, N 45-3799, and Otootan cultivars were resistant. In two other tests, using artificially infested plants, cultivars Palmetto and La. 41-1219 were resistant.

1871. SIMON, J. N. 1954. Vector-virus relationships of pea-enation mosaic and pea aphid *Macrosiphum pisi*. Phytopathology 44:283–289.

The pea-enation mosaic virus was transmitted to soybeans.

1871a. SINCLAIR, J. B., and L. E. GRAY. 1970. Uptake and translocation of ^{14}C-labeled and nonlabeled systemic fungicides by soybean. Proc. 7th Internatl. Cong. Plant Prot. (Paris), p. 736. (Abstr.)

More direct evidence for the translocation of thiobendazole (TBZ) in soybean seedlings was obtained utilizing ^{14}C-labeled TBZ. Radioactivity was detected in the roots, hypocotyl, cotyledon, and epicotyl tissues of soybean seedlings exposed to labeled TBZ in aerated liquid cultures. Thin-layer chromatographic studies with the extracts from seedlings exposed to labeled TBZ showed that the compound apparently did not break down within 7 days in the plant. Benomyl and TBZ tended to accumulate in the cotyledons of treated seedlings, but not in the hypocotyl. This may account, in part, for the general lack of success in using these fungicides as seed treatments for disease control in soybean.

1871b. SINCLAIR, J. B., L. E. GRAY, and P. N. THAPLIYAL. 1971. Systemicity and disease control with certain fungicides in soybean. Proc. 2nd Internatl. Symp. Plant Path. (New Delhi), p. 84. (Abstr.)

Benomyl (benlate); chloroneb (demosan) and ^{14}C-chloroneb; carboxin (vitavax) and ^{14}C-carboxin; oxycarboxin (plantvax); and TBZ (thiabendazole) and ^{14}C-TBZ moved systemically in soybean seedlings whether used as a seed dressing at 0.125, 0.25, or 0.5 g/100 g seed or when seedling roots were exposed to fungicide suspensions. Used as a seed dressing, benomyl tended to accumulate but not localize in cotyledons, chloroneb tended to localize in cotyledons, while carboxin was uniformly distributed throughout the seedling and tended to localize in leaves. Used as a soil drench, benomyl and TBZ tended to localize in cotyledons of young seedlings (1–4 weeks old). In 7-day-old plants, concentration of TBZ and ^{14}C-TBZ was highest in roots and epicotyl, lowest in hypocotyl tissues, and intermediate in cotyledons. TBZ and ^{14}C-TBZ moved unaltered in soybean seedlings, while chloroneb and ^{14}C-chloroneb metabolized into another product. Benomyl was fungistatic to *Cephalosporium gregatum* in vitro and in vivo. In greenhouse and laboratory, at 0.5 g/100 g seed, benomyl reduced internal stem browning to 25% of controls and gave almost complete control at 50 ppm when used as either a soil or sand drench. Chloroneb and carboxin were ineffective. TBZ, used as a soil drench at 200 ppm, inhibited stem browning. Field control was not successful. Benomyl or a fungitoxic component was persistent in drench soil or in plants growing in treated soil for at least 10 weeks.

1871c. SINCLAIR, J. B., L. E. GRAY, W. A. MEYER, R. W. SCHNEIDER, and P. N. THAPLIYAL. 1971. Epidemiology, spread, and control of *Phytophthora megasperma* var. *sojae* and *Cephalosporium gregatum* in soybean. Proc. Symp. Epidemiol., Forecasting and Control of Plant Diseases (Lucknow). (Abstr.)

An abstract of entry 1872a.

1871d. SINCLAIR, J. B., W. A. MEYER, and P. N. THAPLIYAL. 1971. Effects of *Phytophthora megasperma* var. *sojae* infection on soybean. Proc. 2nd Internatl. Symp. Plant Path. (New Delhi), p. 79. (Abstr.)

Phytophthora megasperma var. *sojae* can cause a canker and stem girdling on susceptible soybeans, which brings about stunting and eventual death of the plant. Stunting can occur without canker formation. It was found in field studies that the susceptible cultivar (Amsoy) was considerably shorter than the resistant one (Amsoy 72). There was no evidence of canker formation or other symptoms above the soil line on either type. In a field plot where soybeans had not been grown for at least 20 years, resistant and susceptible cultivars were planted and the soil around the base of 4-week-old plants was infested with the test organism. Examination of the root system of the two cultivars at 1–2 weeks after infestation showed that most feeder roots on Amsoy were severely decayed, while those on the resistant cultivar had little or no damage. Isolations from decayed feeder roots showed that *P. megasperma* var. *sojae* was present in most cases. The fungus was not isolated from the resistant cultivar. In one field plot with soybeans following soybeans, similar results were obtained. In greenhouse studies using Amsoy and the same infestation technique, stunting occurred and the fungus was reisolated from decayed roots. A specially designed system was developed for making root inoculations in the laboratory. Roots of 2-, 6-, and 12-day-old, disease-free Amsoy, Harosoy (susceptible) and Harosoy 63 (resistant) seedlings were inoculated with zoospore suspensions of *P. megasperma* var. *sojae*. Infection of all susceptible seedlings occurred within 8–10 days. The resistant plants remained healthy. Phytoalexin was produced by roots of soybean seedlings.

1871e. SINCLAIR, J. B., and L. E. GRAY. 1972. Three fungi that can reduce soybean yields. Illinois Res. 14(1):5.

A popular article stating that *Cephalosporium gregatum* (brown stem rot), *Macrophomina phaseolina* (charcoal rot), and *Diaporthe phaseolorum* var. *sojae* (pod and stem blight) can reduce soybean yields.

1872. SINCLAIR, J. B., and L. E. GRAY. 1973. The use of symptoms for determining yield reductions in soybean. 2nd Internatl. Cong. Plant Path. Abstrs.:0833.

Symptoms of brown stem rot (BSR) — i.e., length of internal stem browning from the soil line — in soybean caused by *Cephalosporium gregatum* may be used to predict yield losses. Results from studies in a commercial field in 1967 and 1969 showed the extent of stem browning was correlated directly with yield reduction. In 1970, 1971, and 1972, field plots were planted in a BSR-free area in which half the plants were inoculated with *C. gregatum*. Yields of inoculated Clark were reduced 17% below controls in 1970 and yields were reduced 38% in Wayne in 1971, and 25% in Beeson and 31% in Calland in 1972. Vascular browning first appeared in Wayne soybean planted in infested field plots in 1971 and 1972 eight weeks after planting. Height of stem vascular browning increased at 9 weeks and had progressed up the entire stem. In field surveys, average percentage of fields with infected plants by year were 60 in 1968, 44 in 1969, 86 in 1970, and 62 in 1972. The average percentage of infected plants per field by year were 45 in 1968, 53 in 1969, 23 in 1970, and 36 in 1972. Based on average yield reductions under controlled conditions of 25%, the potential yield loss in those fields with BSR in Illinois averaged 10% per year over a 5-year period.

1872a. SINCLAIR, J. B., L. E. GRAY, W. A. MEYER, R. W. SCHNEIDER, and P. N. THAPLIYAL. 1973. Epidemiology, spread and control of *Phytophthora megasperma* var. *sojae* and *Cephalosporium gregatum* in soybean. *In* R. N. Prasad (ed.), Proc. Symp. Epidemiol., Forecasting and Control of Plant Diseases. Indian Natl. Sci. Acad. Bull. 46, pp. 280–284.

Phytophthora root and stem rot, caused by *P. megasperma* var. *sojae,* was first reported in Ohio in 1951 and has spread throughout most of the soybean-growing areas of the United States. This soilborne fungus causes a lesion on the outside of the root and lower stem, progresses upward inducing internal browning, followed by wilting, which may lead to eventual death of the host. *Lupinus* spp. are susceptible. Susceptible soybeans are vulnerable at any age. There are at least two races of the pathogen. Resistant cultivars serve as control with resistance related to quantity rather than quality of phytoalexin produced. Greenhouse and field studies showed that *P. megasperma* var. *sojae* influences plant growth by lateral root pruning. In a specially designed system, it was shown for the first time that soybean roots produce phytoalexin.

Brown stem rot caused by *Cephalosporium gregatum* has been detected in increasing numbers of U.S. soybean fields since 1944. Potential yield losses are not known. The soilborne fungus invades the vascular system, then the pith, and eventually causes a brown discoloration throughout the stem. Mung bean (*Phaseolus aureus*) and red clover (*Trifolium pratense*) are susceptible. Disease development is favored by an air temperature of 15 C and is inhibited at 21 C or above. Optimum temperature for in vitro growth is 22–24 C; for spore production, 15–20 C; and for germination of conidia, 21–25 C. Symptoms develop more rapidly in plants beyond the flowering stage than in younger plants. There

are no commercial resistant cultivars. There is a high positive correlation between disease incidence and acreages devoted to soybean production, but very little between percentage of fields showing diseased soybeans and precipitation during the growing season. A 5-year corn-soybean crop rotation proves to be an effective control measure.

A three-class system for field surveys was proposed to determine prevalence of brown stem rot. Plants rated in the third class (showing browning above the first node) yielded significantly less than plants in the first (no browning) and second (browning to the first node) classes. In laboratory studies, Amsoy seedlings inoculated at 1, 3, 4, 5, 6, and 7 weeks were equally susceptible, but germinating seed and seedlings up to 6 days old were not infected when placed in a mycelial and spore suspension of the fungus. There was no difference in susceptibility of plants inoculated in the greenhouse at 4, 6, 8, and 10 weeks of age. Brown stem rot symptoms developed to a greater extent in inoculated plants grown in a cool (18–24 C) chamber for 2, 4, 6, 8, and 10 weeks than in plants grown in normally high temperatures (22–40 C) in the greenhouse. Six weeks after sowing in infested field soil in the greenhouse, *C. gregatum* was isolated from less than 1% of the roots. At 7 and 8 weeks, however, frequency of isolation was over 75%. Greenhouse experiments suggest that certain systemic fungicides show promise for control.

1872b. SINCLAIR, J. B. 1974. Bacterial and fungal disease of soybean in the tropics and subtropics. Proc. Workshop Soybeans for Trop. and Subtrop. Conditions (Puerto Rico), pp. 112–114.

Summary of causal agents and symptoms of various bacterial and fungal pathogens of soybeans in the tropics and subtropics.

1873. SINCLAIR, J. B. 1974. Systemic fungicides as seed treatments. *In* S. P. Raychaydhuri and J. P. Verma (eds.), Current trends in plant pathology, pp. 252–261. Dept. Botany, Univ. Lucknow, India.

Soybean seeds were either nontreated or treated with benomyl (benlate), BD 18654 (bay dam), carboxin (vitavax), chloroneb (demosan), or TM (topsin-M). Extracts from treated seeds showed that sufficient quantities of the fungicides were absorbed within 4 hr. for benomyl, BD 18654, and TM; 12 hr. for chloroneb; and 24 hr. for carboxin to significantly inhibit bioassay organisms in culture plates. The amount of fungicide absorbed increased with increase in temperature from 20 to 30 C and, in general, increased with increased treatment rates. Benomyl and chloroneb were redistributed into the hypocotyl and cotyledons, whereas only benomyl moved into the epicotyl. Carboxin was distributed uniformly throughout the seedlings, with higher concentrations in the epicotyl tissues. Poor-quality seeds showed greater benefits from the use of systemic fungicides than good-quality seeds.

1874. SINCLAIR, J. B. 1974. The role of the seed coat in disease control of soybeans. Proc. 9th Ann. Illinois Soybean Conf., p. 22. Illinois Crop Imp. Assoc., Urbana.

Three fungi — *Diaporthe phaseolorum* var. *sojae, Cercospora kikuchii,* and *Colletotrichum truncatum* (= *C. dematium* f. *truncata*) — are carried inside the cellular structure of the seed coat.

1875. SINGH, H., G. S. SANDHU, and G. S. MAVI. 1971. Control of yellow mosaic virus in soybean *Glycine max* (L) Merrill. Indian J. Entomol. 33:272–278.

Percentage of virus-infected plants increased in the crop up to the age of 49 days. The reduction in yield of the plants varied from 21.31 to 61.10% depending upon degree of viral infection. Six insecticides, viz., aldicarb, carbofuran, diazinon, disulfoton, lindane, and phorate were tested in granular formulation by soil application. Of all these chemicals, use of aldicarb at 2 kg A.I./ha in two split applications — the first application 2 weeks after germination and the second 3 weeks after the first application — proved highly effective in reducing the virus-infected plants.

1876. SINGH, O. V., V. K. AGARWAL, and Y. L. NENE. 1973. Seed health studies in soybean raised in the Nainital Tarai. Indian Phytopath. 26:260–267.

Soybean seeds when examined for seedborne fungi were found associated with 19 species of fungi and a bacterium *Bacillus* sp. Out of these, *Alternaria tenuis, Aspergillus niger, A. temarii, Chaetomium brassiliense, C. erectum, Penicillium cyclopium, Rhizopus arrhizus, Trichoderma* sp., and *Bacillus* sp. appear to be new records. Other fungi isolated were *Aspergillus flavus, Cladosporium* sp., *Colletotrichum truncatum* (= *C. dematium* f. *truncata*), *Curvularia lunata, Fusarium moniliforme, F. semitectum, Helminthosporium* sp., *Macrophomina phaseolina, Phoma* sp., and *Monilia* sp. Cultivar Clark 63 gave higher counts of fungi than Bragg. Higher temperatures such as 36 C did not suit for soybean seed health detection. The blotter method proved superior over agar plate method. Pretreatment of seeds in the agar plate method reduced a number of fungi to a great extent. Seed treatment with captan and thiram at 0.5% reduced most of the fungi and also increased the emergence significantly.

1877. SINHA, R. C. 1960. Red clover mottle virus. Ann. Appl. Biol. 48:742–748.

When soybean primary leaves are inoculated experimentally the plants show symptoms similar to those of soybean mosaic. Soybean mosaic virus is restricted to soybeans. There was no evidence of seed transmission of red clover mottle virus in soybeans.

1878. SKOLKO, A. J., and J. W. GROVES. 1948.

Notes on seedborne fungi. V. *Chaetomium* species with dichotomously branched hairs. Canad. J. Res. Sect. C. 26:269–280.

Chaetomium funicolum was isolated from soybean seed in Ottawa, Canada.

1879. SKOTLAND, C. B., J. N. SASSER, and N. N. WINSTEAD. 1955. Preliminary report of results of research on the soybean-cyst nematode in North Carolina. Ann. Rpt. Soybean-Cyst Nematode Control, U.S. Dept. Agr. Plant Pest Control Div., pp. 19–33.

Morphological and host range studies are presented as well as the results of chemical experiments to control the cyst nematode harbored on gladiolus corms and narcissus bulbs.

1880. SKOTLAND, C. B. 1955. A Phytophthora damping-off disease of soybean. Plant Dis. Reptr. 39:682–683.

Phytophthora cactorum? described as cause of damping-off of soybean. The fungus caused pre- and post-emergence damping-off. Oospores of the fungus were found in infected tissues. Morphological characters of the fungus are described.

1881. SKOTLAND, C. B. 1956. Life history and host range of the soybean-cyst nematode. Phytopathology 46: 27. (Abstr.)

In studies on the life history of *Heterodera glycines,* roots of soybean seedlings were inoculated with second-stage larvae. After 48 hr. the roots were washed and the seedlings transplanted into nematode-free soil and incubated at 75 F. At 48 hr. intervals roots were examined for male and female development stages, and the soil was examined for the various motile stages. Mature males were found at 14 days and second-generation larvae at 21 days after inoculation. These results suggest that five generations could be produced on a soybean crop in one season in North Carolina. In host range studies, 39 plant species representing 23 genera in the Leguminosae, Cruciferae, Cucurbitaceae, Solanaceae, Gramineae, Chenopodiaceae, Iridaceae, and Amaryllidaceae were inoculated with second-stage larvae under greenhouse conditions. Penetration of several legumes occurred but reproduction occurred only on the roots of annual lespedeza, common vetch, soybean, snapbean, and adzuki bean. Annual lespedeza and common vetch are new hosts for *H. glycines.*

1882. SKOTLAND, C. B. 1957. Biological studies of the soybean-cyst nematode. Phytopathology 47:623–625.

Forty-five plant species representing 28 genera and 9 families were inoculated with larvae of the soybean-cyst nematode, *Heterodera glycines,* in greenhouse tests. Hosts included only species of Leguminosae. Previously unreported hosts were *Glycine gracilis, Vicia villosa, Lespedeza stipulucea, L. striata,* and *L. cuneata.* Hosts reported by Ichinohe and confirmed in these tests included *Glycine ussurensis, Phaseolus vulgaris,* and *P. angularis.* Mature male nematodes were observed 14 days and second-generation larvae 21 days after inoculation of soybean plants with second-stage larvae. These data suggest that four or five generations of this nematode could develop in North Carolina within a growing season. Viability of eggs and of larvae in cysts of the soybean nematode was drastically reduced by desiccation. Few larvae were recovered from cyst material placed in a Syracuse watch glass for 1 month or more and allowed to dry at room temperature. No cysts with viable contents were collected from bulb scales or from soil of narcissus bulbs grown in heavily infested fields, then cured and air-dried for 60 days.

1883. SKOTLAND, C. B. 1958. Bean pod mottle virus of soybeans. Plant Dis. Reptr. 42:1155–1156.

Pod mottle virus was found in naturally infected soybeans in North Carolina and Virginia. All soybean cultivars included in inoculation tests were susceptible. The virus produced local lesions or mottling on various bean cultivars. Some cultivars of cowpea were resistant and others were susceptible to infection. Annual and perennial lespedezas, velvet bean, and crimson clover are reported as hosts for the first time. Lima bean, pea, red clover, sweet clover, crotalaria, broadbean, peanut, alfalfa, ladino clover, tobacco, cucumber, pepper, tomato, and petunia were resistant. The virus was not transmitted by soybean seeds.

1884. SLACK, D. A. 1958. Soybean-cyst nematode. Arkansas Farm Res. 7(3):2.

A popular article. Information is presented on research to provide a better understanding of the biology of soybean-cyst nematodes and effective measures for their control.

1885. SLACK, D. A. 1959. Damage to soybeans by the soybean-cyst nematode. Arkansas Farm Res. 8(5):2.

A popular article, giving a report of studies to assess the damage that might be attributed to the soybean-cyst nematode in the infested areas of Arkansas.

1886. SLACK, D. A., and M. L. HAMBLEN. 1959. Factors influencing emergence of larvae from cysts of *Heterodera glycines* Ichinohe. Influence of constant temperature. Phytopathology 49:319–320. (Abstr.)

An abstract of entry 1887.

1887. SLACK, D. A., and M. L. HAMBLEN. 1961. The effect of various factors on larval emergence from cysts of *Heterodera glycines.* Phytopathology 51:350–355.

The effect of various factors on the emergence of larvae from *Heterodera glycines* cysts was studied under controlled laboratory conditions. Leachate or diffusate from soybean roots failed to stimulate larval emergence. A significantly greater number of larvae emerged from

plump, light-brown cysts than from shrunken, dark-brown cysts or from white or yellow females. Larval emergence from cysts collected on a 40-mesh sieve was not significantly different from smaller cysts that passed through a 40-mesh sieve and were collected on a 60-mesh sieve. Larvae emerged from cysts incubated at constant temperatures maintained at increments of four between 16 and 36 C, but failed to emerge at higher or lower temperatures. Larval emergence was optimum at 24 C. After incubation of cysts at 40 C for 10 days, larvae failed to emerge from cysts when transferred to 24 C. Alternating the incubation temperature between 24 and 16 C reduced larval emergence. Subjecting cysts to −24 C reduced larval emergence from cysts when transferred to 24 C, but failed to eliminate emergence after exposure for 18 months. Emerged larvae were killed by freezing and by exposure to 40 C. Larval collections from Baermann funnels were increased by rupturing cysts. Larvae continued to emerge from cysts after incubation at 24 C for 12 weeks, but 87% emerged during the first 6 weeks. Light failed to affect larval emergence from cysts. Lack of aeration restricted larval emergence from cysts. Larval emergence was greatly reduced by mild desiccation of cysts.

1888. SLACK, D. A., R. D. RIGGS, and M. L. HAMBLEN. 1972. The effect of temperature and moisture on the survival of *Heterodera glycines* in the absence of a host. J. Nematol. 4:263–266.

Soybean-cyst nematode larvae survived in water up to 630 days, depending on incubation temperature. Most larvae were killed when ice crystals formed in water and all died after 1 day at 40 C. At temperatures of 0, 4, 8, and 12 C, larvae survived for the duration of the experiments (630 days). From 16 to 36 C, survival was inversely correlated with temperature. In naturally infested soil, nematode survival was similar but more extended and related to moisture level. Larvae survived 7–19 mo. in flooded soil, 29–38 mo. in dry soil, and 90 mo. in soil maintained near its field capacity.

1889. SLACK, S. A., and J. P. FULTON. 1971. Some plant virus-beetle vector relations. Virology 43:728–729.

Bean leaf beetle (*Cerotoma trifurcata*) transmitted bean pod mottle virus but not tobacco ring spot virus, when fed for 2 hr. on Lee soybean plants infected with either virus. Beetles fed on plants infected with both viruses transmitted only bean pod mottle virus.

1890. SLAGG, C. M. 1944. Soybean diseases in Nebraska. Plant Dis. Reptr. 28:1009.

Records the occurrence and prevalence of Fusarium blight (*F. oxysporum* f. *tracheiphilum*), *Pseudomonas tabaci, P. glycinea,* top necrosis (tobacco ring spot virus) and mosaic virus.

1891. SLAGG, C. M. 1944. Soybean diseases in Kansas. Plant Dis. Reptr. 28:1126.

Reports the prevalence of *Xanthomonas phaseoli* var. *sojense, Pseudomonas glycinea,* tobacco ring spot virus, mosaic virus, and Fusarium blight (*F. oxysporum* f. *tracheiphilum*).

1892. SLEESMAN, J. P., C. LEBEN, A. F. SCHMITTHENNER, and E. COLE. 1969. Relation of *Pseudomonas glycinea* to systemic toxemia in soybean seedlings. Phytopathology 59:1970–1971.

The results suggest that it is uncommon for *Pseudomonas glycinea* to be transferred upward in seedlings from inoculated unifoliolate leaves. Transfer was noted in 4% of the seedlings, and when it did occur, comparatively low numbers of the pathogen were recovered. It appears probable, therefore, that toxemia symptoms result from a substance formed in the inoculated unifoliolate leaves and transported upward.

1893. SLUSHER, R. L. 1972. Development of *Phytophthora megasperma* var. *sojae* in soybean roots. Master's thesis, Univ. Illinois. 32 pp.

See abstracts of entries 1894, 1895, and 1896.

1894. SLUSHER, R. L., and J. B. SINCLAIR. 1973. Techniques for preparing and staining oospores in soybean rootlets. Stain Tech. 48:203–206.

Nylon mesh tissue carriers were constructed to hold soybean rootlet through fixing, dehydrating, and embedding. Mesh pieces ($3cm^2$) were doubled and sealed at each end by heat. Tissue samples were placed inside with an identifying piece of aluminum foil and the carrier sealed. Rootlets were fixed in Karpechenko's solution, dehydrated in an alcohol series, and infiltrated with paraffin. They were embedded in paraffin after removal from the carrier and sectioned on a microtome. Sections were mounted on glass slides and deparaffinized. A new stain was developed to differentiate oospores of *Phytophthora megasperma* var. *sojae* formed in these rootlets. The stain was prepared by dissolving 100 mg bromphenol blue in 50 ml of 95% ethanol and adding 3 g silver nitrate. Procedure: 5 sec. in 95% ethanol, 30 min. in silver stain, tap water rinse, 5 sec. in 95% ethanol, 1 sec. in saturated methylene blue in ethanol, immediate rinse in tap water, dehydration in absolute ethanol, rinse in tertiary butanol and xylene, and mount. Previous clearing of the tissue was not required and no air bubbles accumulated within the mesh carrier. This low-cost permeable carrier preserved the minute tissue specimens throughout processing and the simple, progressive stain clearly differentiated oospores from surrounding tissue.

1895. SLUSHER, R. L., and J. B. SINCLAIR. 1973. Development of *Phytophthora megasperma* var. *sojae* in soybean roots. Phytopathology 63:1168–1171.

A histological stain was developed which is differentially absorbed by oospores of *Phytophthora megasperma* var. *sojae* (*Pms*) in soybean root tissues. Intracellular hyphae

and haustoriumlike bodies were detected in *Pms*-infected root tissues by light-microscope studies. A sand medium favored production of oospores in root tissues of cultivars susceptible Amsoy, field-tolerant Wayne and resistant Amsoy 71 to *Pms*. Wayne roots had as many oospores and greater dry weight when compared with Amsoy roots. Amsoy 71 roots contained few oospores. Oospores were found in Amsoy 71 roots that overwintered in field soil.

1896. SLUSHER, R. L., D. L. HAAS, Z. B. CAROTHERS, and J. B. SINCLAIR. 1974. Ultrastructure at the host-parasite interface of *Phytophthora megasperma* var. *sojae*. Phytopathology 64:834–840.

Ultrastructure and reactions at the host-parasite interface of *Phytophthora megasperma* var. *sojae* in soybean roots were studied. The inter- and intracellular penetration of host cells and tissues by hyphae and the formation of haustoria are described. Evidence of degradation or dissolution of host walls is presented. Lomasomes differed in structure from other *Phytophthora* spp., and a previously undescribed separation between host cytoplasm and host wall was found in areas of fungal contact. Two partially delineated zones within the extrahaustorial matrix are shown. The haustorial wall differed from the hyphal wall by its greater thickness, presence of an outer, dark-staining zone containing electron-dense inclusions, and an outermost granular boundary.

1897. SMALL, H. G. 1958. Cyst nematode (*Heterodera glycines*) no. 1 soybean threat. Crops and Soils 11(2): 9–10.

A popular article presenting information on the damage to soybeans by the soybean-cyst nematode. The possible hazard of growing soybeans where the nematode occurs is evaluated.

1898. SMART, G. C., JR. 1961. Culture of the soybean-cyst nematode. Virginia J. Sci. 12:153.

The soybean-cyst nematode *Heterodera glycines* Ichinohe can be cultured on the roots of soybean plants grown in various potting soils. However, when cysts of the nematode are separated from potting soils by the Cobb sieving and gravity method, debris consisting of nondecomposed organic matter and weed seeds is also retained by the sieves. It is difficult and time-consuming to accurately count or isolate cysts from the debris. In an attempt to eliminate the debris, quartzite sand (Q-Rok) and Attarlay, Attapulgus X-250, Kaolin Type 41, and Pike's Peak clays were tested alone and in various sand-clay proportions for the culture of cysts. These materials proved to be almost free of debris. The nematode reproduced in all artificial potting soils tested, but a 90% sand-10% Kaolin Type clay (by weight) mixture was found to be the most satisfactory for good cyst production.

1899. SMART, G. C., JR. 1962. Distribution of cysts of *Heterodera glycines* in soil at different depths. Phytopathology 52:1221. (Abstr.)

The distribution of cysts of the soybean-cyst nematode (*Heterodera glycines*) was determined in one heavily infested field planted to soybean, *Glycine max* var. Lee, in Nansemond County, Virginia. The soil type is Norfolk loamy fine sand, thick surface phase. In August, holes were dug and soil samples collected from the soil profile under a row of soybeans from the surface to a depth of 5 ft. The highest population of cysts occurred at 3–6 in. with diminishingly fewer cysts at deeper levels. At 18 in., the dark surface soil ended and the number of cysts and roots diminished sharply. The A horizon extended to about 30 in. and again there was a noticeable decline in cyst numbers below that level. Cysts were not found deeper than 3½ ft., but soybean roots were found at 5 ft. These findings indicate that cysts as deep as 3½ ft. must be considered in studies of the viability and eradication of the soybean-cyst nematode.

1900. SMART, G. C., and B. A. WRIGHT. 1962. Survival of the cysts of *Heterodera glycines* adhering to stored sweet potato, peanut, and peanut hay. Virginia J. Sci. 13:219–220. (Abstr.)

Larvae in cysts adhering to sweet potato, peanut, and peanut hay in storage were viable after 12 months under all test conditions, which is longer than the normal storage period for these products.

1901. SMART, G. C., JR. 1963. Survival of encysted eggs and larvae of the soybean-cyst nematode, *Heterodera glycines*, ingested by swine. Phytopathology 53: 889–890. (Abstr.)

An abstract of entry 1907.

1902. SMART, G. C., JR. 1964. The effect on yields of soybeans infested with the soybean-cyst nematode, *Heterodera glycines*, from Virginia. Virginia J. Sci. 15(4):265. (Abstr.)

Greenhouse and field experiments were conducted to determine whether soybean yields are reduced by large numbers of *Heterodera glycines* Ichinohe, 1952, from Virginia. Greenhouse tests were conducted in 6-in. clay pots using field soil fumigated with methyl bromide. Soybean cultivar Lee was used in all tests. Yields were determined by weighing shelled beans and oven-dried stems (plus foliage). Combining the data from four greenhouse tests, with a total of 38 pots of plants and an average of 3,812 (228–10,000) cysts per pot, the bean yield from inoculated plants averaged 25% less and the stem yield averaged 31% less than from noninoculated plants. Eight field plots were laid out on heavily infested soil and four of the plots were fumigated with 80 gal./acre of DD 2 weeks before planting. The average bean yield from nonfumigated plots was 46% less and the average stem yield was 45% less than from fumigated plots. Other stylet-bearing nematodes, especially north-

ern root-knot and spiral, were present in large numbers, and the amount of yield reduction attributable to them is not known. *H. glycines* populations used in these experiments were much higher than normally found in the field in Virginia.

1903. SMART, G. C., JR. 1964. Additional hosts of the soybean-cyst nematode, *Heterodera glycines,* including hosts in two additional plant families. Plant Dis. Reptr. 48:388–390.

Ten additional host species of the soybean-cyst nematode were discovered including hosts in two plant families not previously reported. New hosts are mouse-ear chickweed (*Cerastium vulgatum*) and common chickweed (*Stellaria media*) in the Caryophyllaceae; common mullein (*Verbascum thapsus*), the beard-tongues (*Pentstemon albertinus, P. glaber, P. grandiflorus, P. polyphyllus,* and *P. unilateralis*) in the Scrophulariaceae; and low hop clover (*Trifolium procumbens*) and sickle pod, sickle senna, or coffee bean (*Cassia tora*) in the Leguminosae. This is the first report of hosts in the families Caryophyllaceae and Scrophulariaceae and the second report of hosts other than legumes.

1904. SMART, G. C., JR. 1964. Physiological strains and one additional host of the soybean-cyst nematode, *Heterodera glycines.* Plant Dis. Reptr. 48:542–543.

An isolate of the soybean-cyst nematode (*Heterodera glycines*) from North Carolina and an isolate from Arkansas were compared in their development on two species of beard-tongue (*Pentstemon digitalis* and *P. unilateralis*) with soybean (*Glycine max* Lee), the type host species of *H. glycines,* used as inoculated controls. The North Carolina isolate did not develop on the beard-tongues, but large numbers of white females (fourth and fifth stages) and cysts were recovered from soybean. The Arkansas isolate developed in small, but about equal, numbers on both species of beard-tongue and on soybean. The two nematode isolates, therefore, exhibit physiological strains of *H. glycines. P. digitalis* is also reported for the first time as a host of *H. glycines.*

1905. SMART, G. C., JR. 1964. Environmental factors affecting nematode injury. Proc. Soil Crop Sci. Soc. Fla. 24:294–302.

This is a review article covering environmental factors affecting nematode injury. Specifically, the author discusses the survival of larvae, eggs, and encysted larvae of *Heterodera glycines* at varying relative humidity. Temperature effects on larval emergence are also discussed. The cultivar Peking, as a source of resistance to the soybean-cyst nematode, is also mentioned.

1906. SMART, G. C., JR., O. J. DICKERSON, and R. L. SMITH. 1968. Reproduction of the soybean cyst nematode on Pickett, Dyer, and Hampton soybeans. Proc. Soil Crop Sci. Soc. Fla. 28:306–309.

The resistant soybean cultivars Pickett and Dyer were found to be highly resistant to a population of *Heterodera glycines* present near Cantonment, Fla., whereas the susceptible cultivar Hampton was heavily infested. Crop rotation is recommended as a means of reducing the possibility of races capable of attacking resistant cultivars.

1907. SMART, G. C., JR., and H. R. THOMAS. 1969. Survival of eggs and larvae in cysts of the soybean cyst nematode, *Heterodera glycines,* ingested by swine. Proc. Helminth. Soc. Washington 36:139–142.

Of 18,000 cysts of *Heterodera glycines* ingested by 6 pigs, 19.4% were recovered from the feces. Six larvae emerged from the cysts incubated for larval emergence. The larvae were alive but had highly vacuolated intestines. When these larvae and all cysts recovered from the feces were placed in pots of soil containing Lee soybean, a known host, no cyst nematodes developed.

1908. SMARTT, J. 1960. Some factors limiting the production of edible legumes in Northern Rhodesia. Rhodesia and Nyasaland Dept. Res. and Spec. Serv., Proc. Ann. Conf. Prof. Off. 4:10–15.

The crop has been markedly free from disease except for *Pseudomonas glycinea.*

1909. SMARTT, J. 1960. A guide to soya bean cultivation in Northern Rhodesia. Rhodesia Agr. J. 57:459–463.

Ascochyta sp., *Mycosphaerella, Phyllosticta,* and *Pyrenochaeta* are reported as causing minor leaf diseases. *Sclerotium rolfsii* is usually of minor importance. Mosaic is noted as being seedborne and infected plants should be removed from seed production fields. The seeds may be discolored by a fungus tentatively regarded as *Cercospora kikuchii.*

1910. SMITH, A. L., and A. L. TAYLOR. 1947. Field methods of testing for root-knot infestation. Phytopathology 3:85–93.

Root-knot index, based on percentage of the root system with visible galls, and relative root-knot index, based on the adoption of standards for each root-knot class with the remainder of the roots graded by comparison with the standards selected, are described for testing field infestation of root-knot nematodes. In soybean cultivar tests, Laredo was found more resistant, Biloxi and Otootan were intermediate, and Clemson and Georgian were most susceptible.

1911. SMITH, E. F. 1904. Bacterial leaf spot diseases. Science (n.s.) 19:417–418.

1912. SMITH, F. H. 1973. Soybean (*Glycine max*), lance nematode (*Hoplolaimus columbus*). Amer. Phytopath. Soc. Fungicide and Nematicide Tests, Results of 1972. 28:176–177.

The experiment consisted of row subsoiled and nonrow subsoiled plots. The nematicides dasanit and mocap made up the subplots and different rates of these materials made up the sub-subplots. Subsoiling was done with a 4-row subsoil plow to a depth of about 14 in. Nematicides were banded (12 in.) with a Demco granule applicator and incorporated 2 to 3 in. deep with a gang from a Lilliston rolling cultivator. *Hoplolaimus columbus* populations approached natural uniformity in the test site at time of planting. These populations rated mostly high (200 + /100 cc of soil) in check and nonchemically treated plots throughout the growing and harvest seasons. Row subsoiling did not seem to influence population. The presence of either nematicide increased yields significantly. There were no significant differences in row subsoiling, different nematicidal rates, or interactions.

1912a. SMITH, F. H. 1973. Soybean (*Glycine max,* Hampton 266A) sting nematode (*Belonolaimus* spp.). Amer. Phytopath. Soc. Fungicide and Nematicide Tests, Results of 1972. 28:177.

The experiment consisted of row subsoiled and nonrow subsoiled whole plots. The nematicides dasanit and mocap made up the subplots and different rates of these materials made up the sub-subplots. Subsoiling was done with a 4-row subsoil plow to a depth of about 14 in. Nematicides were banded (12 in.) with a Demco granule applicator and incorporated 2 to 3 in. deep with a gang from a Lilliston rolling cultivator. *Belonolaimus* spp. were present in populations ranging from few to high in some plots during the growing season. *Trichodorus* spp. and *Criconemoides* spp. were present in low numbers in a few plots. Row subsoiling did not seem to influence populations. Various rates of either nematicide increased yields significantly. There were no significant differences for row subsoiling or nonrow subsoiling independent of nematicides. Certain interactions were significantly better.

1912b. SMITH, H. L. 1971. Bare-root chemical dips for the control of soybean cyst nematodes adhering to vegetable and nursery transplants. Plant Dis. Reptr. 55: 13–16.

Tests with 5 nematicides for control of the Virginia strain of the soybean-cyst nematode (*Heterodera glycines* Ichinohe) in pot tests showed that ethyl 4-(methylthio)-m-tolyl isopropylphosphoramidate at 600 and 1,000 ppm, 0,0-diethyl 0-[p-(methylsulfinyl) phenyl] phosphorothioate at 1,000 and 2,000 ppm, and 0,0-diethyl 0-2-pyrazinyl phosphorothioate at 2,484 and 4,857 ppm were effective in controlling this nematode. No phytotoxic effects on tomato and cabbage transplants or 9 cultivars of nursery stock were observed with these chemicals when used as a 15-min. bare-root dip.

1912c. SMITH, K. M. 1937. A textbook of plant virus diseases. Churchill, London. 615 pp.

1912d. SMITH, K. M. 1952. Some garden plants susceptible to infection with cucumber mosaic virus. Royal Hort. Soc. (London) J. 77:19–21.

Soybean is susceptible when inoculated with chrysanthemum mosaic virus. This virus is not quite the same as that of cucumber mosaic virus, but is closely related.

1912e. SMITH, M. A., and B. W. KENNEDY. 1968. The effect of light quantity and quality on soybean leaves infected by *Pseudomonas glycinea.* Phytopathology 58:1068. (Abstr.)

The undersurfaces of fully unfolded unifoliolate leaves were inoculated with a water suspension of bacteria via a Passche airbrush. Water-soaking was more extensive in soybean leaves inoculated with *Pseudomonas glycinea* and maintained in white light at 2,000 ft.-c than at 55–60 ft.-c. Water-soaking did not develop in soybeans maintained in the dark after inoculation. Water-soaking occurred in soybean leaves in white (760–290 mμ), red (760–610 mμ), and blue (490–420 mμ) light of approximately equal energy levels. Necrosis, similar to the resistant hypersensitive reaction, occurred in inoculated, susceptible soybean leaves when maintained in darkness or in green or blue light for 24–48 hr. A histological study of soybean leaves indicated plasmolysis occurred 24 hr. after inoculation in resistant tissue.

1912f. SMITH, M. A., and B. W. KENNEDY. 1970. Effect of light on reactions of soybean to *Pseudomonas glycinea.* Phytopathology 60:723–725.

Bacterial leaf blight did not develop when susceptible plants were placed in darkness for 5 days after, or 4 days before, the five days after inoculation with the pathogen. As postinoculation light intensity treatments were increased from 50–60 ft.-c to 2,000–2,500 ft.-c, size and prevalence of susceptible-type lesions increased on the host. In light regimes of similar energy levels, normally susceptible reactions of bacterial blight of soybean did not occur in green or blue light, but developed fully in white, and to a limited extent in red light. Preinoculation and postinoculation darkness treatments did not alter development of the resistant (hypersensitive) reaction in soybean cultivars inoculated with avirulent races of *Pseudomonas glycinea.*

1913. SMITH, P. E., and A. F. SCHMITTHENNER. 1959. Further investigations of the inheritance of resistance to *Phytophthora* rot in the soybean. Agron. J. 51: 321–323.

Inheritance of resistance to *Phytophthora sojae* in soybeans was studied using two crosses each involving one resistant and one susceptible parent. F_2 populations were grown in the field in 1956 and classified into resistant and susceptible groups. F_3 progenies from a random sample of F_2 plants of both crosses were grown in the greenhouse in 1957, artificially inoculated with *P. sojae,* and classified as resistant, segregating, and susceptible.

F_4 progenies from four selected F_2 plants of the cross (Blackhawk × Capital) were grown in the greenhouse in 1958, artificially inoculated with *P. sojae,* and evaluated for disease reaction. The data support the conclusion that resistance is dominant and conditioned by a single major gene pair, and that the dominant allele is modified by other genes which tend to inhibit the full expression of resistance. Other possible explanations are also discussed.

1914. SMITH, P. E. 1962. Registration of Henry (No. 34), Madison (No. 35), and Ross (No. 36) soybeans. Crop Sci. 2:534.

Cultivars Henry, Madison, and Ross are resistant to *Phytophthora megasperma* var. *sojae.*

1915. SMITH, T. E. 1939. Host range studies with *Bacterium solanacearum.* J. Agr. Res. 59:429–440.

Soybeans were susceptible to artificial inoculation by inserting into the stem wedges of discolored tissue from the woody cylinder of affected tobacco plants, but apparently were unaffected through the roots by the soilborne parasite.

1916. SOLORIO, C. B. 1967. The interrelation of time of flowering and height in short season soybeans and the inheritance of disease resistance. Diss. Abstr. 28 B:416.

The inheritance of resistance to *Xanthomonas phaseoli* var. *sojense* and *Phytophthora megasperma* var. *sojae* in the progeny of a cross between DA 60-13-1 and PI-171, 450 was governed by a single gene for each disease. Resistance to *X. p.* var. *sojense* was recessive and to *P. m.* var. *sojae,* dominant.

1917. SOMERVILLE, A. M., JR., and U. H. YOUNG, JR. 1956. Review of plant parasitic nematodes found in Virginia during 1955. Virginia J. Sci. 7:259–260. (Abstr.)

During 1955, plant and soil samples from many sections of Virginia were examined. From these samples, nematodes from 14 of 23 known plant-parasitic genera were isolated and identified. The preliminary data accumulated indicate that scope of the nematode problem is of sufficient importance to warrant a systematic survey.

1918. SOMMERS, L. E., R. F. HARRIS, F. N. DALTON, and W. R. GARDNER. 1970. Water potential relations of three root-infecting *Phytophthora* species. Phytopathology 60:932–934.

The effect of nutritional status and manner of water potential control on the susceptibility to water stress of three soilborne *Phytophthora* spp. was investigated. The osmotic water potential relations of *P. cinnamomi, P. megasperma* var. *sojae,* and *P. parasitica* were relatively independent of the inorganic solute (KCl or salt mixture) used for water potential control of a low organic nutrient agar medium. Optimum growth of *P. cinnamomi* occurred at −10 to −15 bars; *P. megasperma* var. *sojae* growth rate declined steeply with decreasing potential, and growth ceased at about −30 bars; although *P. parasitica* growth also declined with decreasing potential, some growth occurred at −50 bars. Substitution of sucrose to control the water potential of the basal medium or the use of nutrient-rich media increased the growth rates at all water potential levels. The nutrient-water potential interaction was particularly pronounced for *P. parasitica.* On V-8 juice media, no appreciable water stress occurred before −15 bars, and vigorous growth was evident at −40 bars.

1919. SOONG, M., and G. M. MILBRATH. 1973. Effect of light and buffer solutions on local lesion production in Top Crop bean by soybean mosaic virus. 2nd Internatl. Cong. Plant Path. Abstrs.:0925.

Several French bean (*Phaseolus vulgaris*) cultivars were tested for a local lesion response to soybean mosaic virus. The cultivars tested were Bountiful, Great Northern, Idaho Refugee, Kentucky Wonder, Kentucky Wonder Wax, Pinto, Red Kidney, and Top Crop. Several buffers, 0.5 M Na-citrate, pH 7.5; 0.05 M Na-citrate pH 6.6; 0.05 M K-phosphate, pH 7.0; 0.05 M Na-phosphate, pH 7.0; 0.05 M Tris-HCl, pH 8.0; and 0.05 M borate, pH 8.2 were compared with distilled water. The use of Top Crop bean and 0.05 M Na-phosphate, pH 7.0, produced the best results. The other cultivars were erratic in lesion formation. Local lesions could be counted 48 hr. after inoculation when given a 12-hr. dark treatment prior to inoculation. Inoculum was applied to the leaves with cotton swabs. Detached leaves were placed on moist filter paper in a petri dish and incubated under continuous light at 30 C. The lesions initially formed as discrete necrotic local lesions followed by necrosis spreading along the small veins. Local lesions were not produced when left attached to plants and maintained in the greenhouse following inoculation. The assay host provided a reproducible system for quantitative assays when light and buffer systems were controlled.

1920. SOUTHERN, J. W., and N. C. SCHENCK. 1974. The effect of temperature and oospores of *Pythium myriotylum* and *P. irregulare* on the soybean cultivar "Bragg." Proc. Amer. Phytopath. Soc. 1:29. (Abstr.)

Noninfested and infested soil with 250 oospores/g of soil of either *Pythium myriotylum* or *P. irregulare* was held at 20, 25, 30, and 35 C (test 1) and 23, 28, 33, and 39 C (test 2). Each treatment was replicated six times and each replicate had 2 kg of autoclaved Arredondo fines sand (ca. WHC 8%, pH 6.2). Soil moisture level during test 1 was ca. 100% WHC and was ca. 75 to 100% WHC during test 2. Five seeds were sown in each container 3.8 cm deep. Results were taken 14 days later. Plant height in soil infested with *P. irregulare* oospores was significantly reduced from the control at 20, 23, and

25 C (1%) and at 33 C (5%). Root weight also was reduced at 20 and 30 C (1%) and at 35 C (5%). With *P. myriotylum* oospores, plant height was reduced at 20, 23, 25, and 30 C (1%). Also root weight was reduced at 20 and 25 C (5%) and at 30 and 35 C (1%). The percentage retrieval of *P. irregulare* propagules from soil after 14 days at 20, 25, 30, and 35 C was 412, 310, 242, and 50% respectively, and at 23, 28, 33, 39 C was 236, 54, 2, and 0%, respectively, of the initial inoculum density.

1921. SPASIC, M. 1961. A contribution to the knowledge of the parasitic flora on cultivated plants in Timoska Krajina (Yugoslavia) [in Croatian, English summary]. Zashtita Bilja 63/64:57–63.

During the 1960–61 season minor attacks by *Alternaria* sp., *Bacterium phaseoli* (= *Xanthomonas phaseoli*), and by soybean mosaic and intensive attacks by *Peronospora manshurica* were noted.

1922. SPEARS, J. F. 1955. Progress report of soybean-cyst nematode control program for calendar year 1955. U.S. Dept. Agr., Agr. Res. Serv., Plant Pest Control Div. 25 pp.

This report deals with the history, distribution, and quarantine regulations of the soybean-cyst nematode, plus the effects of that nematode on the soybean industry. Included are means of spread and suggested control measures.

1923. SPEARS, J. F., F. I. BOWEN, and C. D. BOWERS. 1956. Soybean-cyst nematode found in new area. Plant Dis. Reptr. 40:830.

The soybean-cyst nematode (*Heterodera glycines*) was reported for the first time near Burgaw, N.C., U.S.A.

1924. SPEARS, J. F., S. C. BALCOMBE, and G. HEMERICK. 1957. Detection of *Heterodera glycines* in North Carolina. Phytopathology 47:33. (Abstr.)

Symptoms of soybean-cyst nematode disease were visible on snap bean and soybean foliage 6 weeks after planting where cyst count prior to planting was 5–200 cysts/lb. soil; at 1 cyst/lb., symptoms were observed on soybean 12 weeks after planting; at 1 cyst/10 lb. soil/acre, no symptoms were observed. Symptoms were conspicuous on diseased plants where relatively healthy soybean plants were growing rapidly, i.e., where other conditions were favorable for growth. In such fields, diseased plants were in elliptical areas, 1 × 2 to 10 × 20 yd. across. Diseased plants were 7–10 in. high where surrounding healthy plants were 38–42 in. high. Diseased plants were yellow, with the chlorosis beginning distally on the foliage. Roots of diseased plants were small, dark, odorless, and had few or no nodules. Cysts were plainly visible on such roots. Over 100,000 acres of soybeans in eastern North Carolina were inspected for symptoms of this disease in 1956. Five infested properties were discovered, extending the limits of the known infested area 3 miles east, 3 west, and 7 north.

1925. SPEARS, J. F. 1957. The soybean-cyst nematode and your industry. Soybean Dig. 17(11):56–59.

A popular article. Information on the history of the soybean-cyst nematode, means of spread, and suggestions for control are presented.

1926. SPEARS, J. F. 1959. The nematode problems. Agr. Chem. 14(2):36–38.

A popular article dealing with a number of nematodes, including the soybean-cyst nematode.

1927. SPEARS, J. F. 1959. Current status of the soybean-cyst nematode. Soybean Dig. 19(11):58–61.

A popular article. A general review of the distribution, spread, and use of rotations for control is presented.

1928. SPEARS, J. F. 1961. Latest developments on the soybean-cyst nematode. Soybean Dig. 21(11):28–31.

A popular article, giving a general review of soybean-cyst nematode problems, with estimates of losses in the infested states. Suggestions on control are presented.

1929. SPEARS, J. F. 1962. Can the soybean cyst be controlled? Soybean Dig. 11(1):3.

A popular article giving general appraisal of the soybean-cyst nematode, distribution in United States, stage infested, and status of the problem. Use of resistant cultivars and crop rotation are best control measures. Chemical treatment of soil is suggested.

1930. SPEARS, J. F. 1963. Cyst nematode: its status as threat to midsouth beans. Cotton Farming Mag. 7(1):26–28.

A general appraisal of the cyst nematode, a review of its distribution, and some suggestions for control.

1931. SPEARS, J. F. 1969. Organized nematode control programmes in the USA. *In* J. E. Peachey (ed.), Nematodes of tropical crops, pp. 314–323. Tech. Commun. Commonw. Bur. Helminth. Farnham Royal, Bucks, England.

This article discusses integrated control measures in combating nematode diseases of plants. *Heterodera glycines* on soybeans is used as one of the examples.

1932. SPENCER, J. A., and H. J. WALTERS. 1969. Variation in certain isolates of *Corynespora cassicola.* Phytopathology 59:58–60.

The existence of two distinct races of *Corynespora cassicola* was confirmed by differential responses of *Vigna sinensis* and *Glycine max* to infection by 14 monoconidial isolates of the fungus from plants grown in six southeastern states. Eight new hosts for the fungus, *Abutilon theophrasti, Ricinus communis, Cyamopsis tetragono-*

loba, Lupinus angustifolius, L. albus, L. luteus, Stizolobium deeringianum, and *Citrullus vulgaris* were found. Morphologic, pathogenic, and cultural differences between isolates used in this study from southern states, and isolates found in Nebraska and Canada, suggest the existence of a variant at the species level, different from the two races considered in this study.

1933. SPRAGUE, R. 1942. Soybean diseases in western North Dakota. Plant Dis. Reptr. 26:382.

Bacterial blight was common. *Fusarium scirpi* var. *acuminatum* and *Pythium debaryanum* were frequently isolated from soybean seeds.

1934. STAHL, C., L. N. VANDERHOEF, N. SIEGEL, and J. P. HELGESON. 1973. *Fusarium tricinctum* T-2 toxin inhibits auxin-promoted elongation in soybean hypocotyl. Plant Phy. 52:663–666.

T-2 toxin, a mycotoxin produced by *Fusarium tricinctum,* inhibited elongation of excised hypocotyl sections of soybean cultivar Hawkeye 63. Auxin-promoted elongation was inhibited more severely than was control elongation, and a 1-hr. preincubation of 5 M toxin prevented the induction of a faster rate of elongation by auxin. While inhibition of elongation by cytokinin was similar to that of the toxin, the mode of action of the two compounds appeared to be different, i.e., their effects on elongation were additive, and only kinetin promoted radial enlargement. Toxin treatment did not diminish cytokinin-induced radial enlargement. The properties of the plasma membrane, as measured by electrolyte leakage, were not affected by the toxin.

1935. STANDEN, J. H. 1952. Host index of plant pathogens of Venezuela. Plant Dis. Reptr. Suppl. 212:59–106.

Meloidogyne marioni is reported on soybeans.

1936. STEERE, R. L. 1953. Tobacco ringspot virus, a polyhedron, purified with the use of butanol. Phytopathology 43:485. (Abstr.)

Particles 25 nm in diameter, which have infectivity associated with them and which appear hexagonal in electron micrographs, have been isolated from plants of Caserta squash infected with tobacco ringspot virus. These particles are concentrated and purified by a procedure in which the noninfectious plant components are removed from the juice of infected plants by emulsification of the juice with 1½ volumes of n-butyl alcohol followed by a series of low- and high-speed cycles in a Spinco preparative centrifuge. Healthy plants of the same squash, grown simultaneously and passed through the same purification procedure, yielded no such particles.

1937. STEVENSON, J. A. 1926. Foreign plant diseases. U.S. Dept. Agr., Office of the Secretary. 198 pp.

Lists 19 diseases attacking *Soja* spp. which are new to or not widely distributed in the United States.

1938. STEWART, R. B. 1957. An undescribed species of *Pyrenochaeta* on soybean. Mycologia 49:115–117.

Report from Ethiopia describes a hitherto undescribed *Pyrenochaeta, P. glycines* n.sp., with pycnidia 110–160 μ in diameter, and hyaline (greenish-yellow in mass) oval to short-cylindrical, straight to slightly curved pycnidiospores measuring 2–3 $\times$ 4.5–7.5 μ. The spots appear as small, dark reddish-brown, circular to irregular lesions. The older ones are necrotic, gray to dark brown in the center, and have a dark-brown, almost black, narrow border. Some lesions are surrounded by a chlorotic halo. The center, sprinkled with small black pycnidia visible macroscopically, may fall out in old lesions. The spots measure up to 2 cm in diameter, but may coalesce and cover the greater part of the leaf surface. Affected leaves become chlorotic and fall. Cultivars with pale leaves are generally more susceptible than those with dark ones. The fungus was also found on uncultivated *Glycine javanica* in the vicinity.

1939. STEYAERT, R. L. 1934. [Observations on stigmatomycosis of cotton bolls in Belgian Congo.] Agr. Congo Belge Bull. 25, pp. 473–493.

Soybean is recorded as one of the alternate hosts of *Nematospora coryli* and *N. gossypii.*

1940. STEYAERT, R. L. 1948. [Contribution a l'étude des parasites des végétaux du Congo Belge.] Soc. Bot. Belg. Bull. 80, pp. 11–58.

Includes a record of *Nematospora phaseoli* on soybean.

1941. STODDARD, D. L. 1945. Seed treatment. Federal Expt. Sta. Puerto Rico Rpt. 1944, pp. 28–29.

Seed treatment of soybean with arasan, semesan, and spergon gave protection against seed rots and pre-emergence damping-off.

1942. STOLLER, E. W., E. J. WEBER, and L. M. WAX. 1973. The effects of herbicides on soybean seed constituents. J. Environ. Qual. 2:241–244.

The effects of 24 herbicides on soybean seed yield, weight, protein, nonprotein N, oil, and fatty acid composition were investigated for several cultivars in 1969, 1970, and 1971. Significant but very small alterations in the measured parameters were noted for some herbicides, applied alone or in combination. The greatest difference observed was a reduction in seed yield due to injury from excessive herbicide rates or competition from weeds not controlled. Practical importance of the apparent alterations in seed composition caused by the herbicides is considered inconsequential.

1943. STONE, G. M., and J. L. SEAL. 1944. Plant diseases observed in Alabama in 1943. Plant Dis. Reptr. Suppl. 148:276–280.

Most important diseases of soybean were caused by mosaic virus and *Sclerotium rolfsii.* Minor pathogens were *Pseudomonas glycinea, Peronospora manshurica, Diaporthe sojae* (= *D. phaseolorum* var. *sojae*) and *Cercospora sojina.*

1944. STONE, W. J., and J. P. JONES. 1960. Corynespora blight of sesame. Phytopathology 50:263–266.

Corynespora cassicola from sesame and soybean were pathogenic to both hosts in cross-inoculation tests. The fungus also was seedborne.

1945. STRELECKI, R. F. 1963. The effect of *Diaporthe phaseolorum* varieties *sojae* and *caulivora* on soybean seed germination and growth in New Jersey. Master's thesis, Rutgers Univ., New Jersey. 44 pp.

Two diseases are caused by *Diaporthe phaseolorum* on soybeans. These are pod and stem blight caused by *Dp.* var. *sojae* and *Dp* var. *caulivora.* Pod and stem blights are quite common in New Jersey. Severely infected plants produce seeds that are often moldy or fissured. Germination tests showed an inverse correlation between the percentage of *Diaporthe* present within the seed and the germination of the seeds — that is, seeds that contain a percentage. The *Diaporthe* in the seed also adversely affects soybean seedlings. Tests conducted with infected seeds showed that seedlings often are stunted or deformed and have cotyledons that show brown, sunken lesions caused by *Dps.* This effect is especially produced by infected seeds of cultivars Clark and Hawkeye. In culture, several isolates of the pod and stem blight organism showed variation in morphological characteristics.

1946. STRISSEL, J. F., and J. M. DUNLEAVY. 1970. Stunting of soybeans by *Pythium debaryanum.* Phytopathology 60:961–963.

Pythium debaryanum caused unusual symptoms on soybeans. The fungus incited dry, necrotic lesions on the cotyledons, death of the apical meristem, development of axillary shoots at the cotyledonary node, and a swelling of the hypocotyl. Infected plants of susceptible cultivars were severely stunted, and death of seedlings often resulted. This resulted in a 40% reduction in stand. The stand was increased with cyano-(methyl-mercuri) guanidine applied as a seed treatment. Plant height was a reliable measure of disease resistance. Mandarin (Ottawa) was the most resistant and Ontario and Manchu T3 were the most susceptible cultivars tested.

1947. STROUBE, W. H. 1954. Host range of the Rhizoctonia aerial blight fungus in Louisiana. Plant Dis. Reptr. 38:789–790.

Soybean is affected by *Rhizoctonia sasakii.*

1948. STUBBS, M. W. 1936. Viroses of the garden pea, *Pisum sativum.* Phytopathology 26:108–109. (Abstr.)

An abstract of entry 1949.

1949. STUBBS, M. W. 1937. Viroses of garden pea, *Pisum sativum.* Phytopathology 27:242–266.

Pea virus 1 (pea-enation virus) infected soybeans in host range studies.

1950. SUGIYAMA, S., and H. KATSUMI. 1966. A resistant gene of soybeans to the soybean-cyst nematode observed from the cross between Peking and Japanese varieties [in Japanese]. Japan. J. Breed. 16:83–86.

Peking, a cultivar highly resistant to *Heterodera glycines,* was crossed reciprocally with incompletely resistant Namashirazu and susceptible Shiromeyutaka. F_2 progenies were tested for resistance, and relationships with some other characters also were examined. Frequencies of the resistant plants were ¼ for Peking × Namashirazu and almost 1/16 for Peking × Shiromeyutaka, thus indicating 1 (for the former) or 2 (for the latter) recessive genes concerned with resistance. In these crosses a coupling linkage between the resistance allele and that which determines the expression of seed color (black or brown) was found. This resistant recessive gene was designated rhg_1.

1951. SUGIYAMA, S., and K. HIROMA. 1968. Studies on the resistance of soybean varieties to *Heterodera glycines.* I. Intervarietal differences in resistance [in Japanese, English summary]. Japan. J. Breed. 18:80–87.

Experiments on the resistance of soybean cultivars to *Heterodera glycines* led to the classification of resistance into that of the type of cultivar Peking and that of the type of cultivar Gedenshirazu. Cultivars of the Peking type were more resistant to attack by *H. glycines.*

1952. SUGIYAMA, S., and K. HIROMA. 1968. Studies on the resistance of soybean varieties to the soybean-cyst nematode. I. Comparison of varietal responses [in Japanese, English summary]. Japan. J. Breed. 18:16–23.

Resistance of soybeans to the soybean-cyst nematode was tested in two field experiments, and a successive observation was made of the number of cysts and amount of nodulation in pot cultures. With these cultivars, two types of resistance, Peking and Gedenshirazu, were classified.

1953. SUGIYAMA, S., et al. 1968. Studies on the resistance of soya-bean varieties to *Heterodera glycines.* II. Difference of physiological strains from Kariwano and Kikyogahara [in Japanese, English summary]. Japan. J. Breed. 18:206–212.

A population of *Heterodera glycines* from Kikyogahara, Japan, was more pathogenic on soybean than a population from Kariwano, Japan. It was concluded that two different strains of the nematode were involved.

1954. SUHOVECKY, A. J., and A. F. SCHMITTHENNER. 1955. Soybeans affected by early root rot. Ohio Farm and Home Res. 40:85–86.

A popular article describing symptoms and losses by Phytophthora rot (= *P. megasperma* var. *sojae*). Seed treatment with arasan, phygon, spergon, and ortho-seed guard had no effect on reduction of seedling blight.

1955. SUHOVECKY, A. J. 1955. A Phytophthora root rot of soybeans. Diss. Abstr. 15:1991–1992.

Most of this information concerning an important damping-off and root rot of soybeans in silty clay soils in northwestern Ohio caused by *Phytophthora* sp. has already been noticed from another source. In greenhouse experiments the cultivar Monroe was significantly more resistant than Earlyana or strain W9-2024 at soil temperatures of 15 and 25 C. Blackhawk was more resistant than Lincoln or Harosoy at 15, 25, and 35 C and Monroe and Blackhawk more susceptible at 35 than at 15 or 25 C. Incidence was less in nonsteamed field soil infested with *Phytophthora* than in soil steamed prior to infestation, and was significantly less in the latter when a species of *Fusarium* was added. Of the four soybean cultivars recommended for Ohio, only Monroe was resistant, as was OH-53, a selection from the susceptible Bavender.

1956. SUN, S. D. 1958. Soybean [in Russian]. 248 pp. Moscow.

In chapter 13 of this work translated from the Chinese, pests and diseases of soybean in China are recorded, with short notes on symptoms, distribution, and control. Among those listed are soybean mosaic virus, *Cercospora sojina, Peronospora manshurica, Xanthomonas glycines* (= *X. phaseoli* var. *sojense*), *Septoria glycines,* and *Uredo sojae* (= *Phakopsora pachyrhizi*).

1957. SUPREME COMMANDER OF THE ALLIED POWERS. 1949. Japanese natural resources; a comprehensive survey. Tokyo, Japan. 559 pp.

Anthracnose of soybean is listed under major food crop diseases.

1958. SUTTON, J. C. 1973. Development of vesicular arbuscular mycorrhizae in crop plants. Canad. J. Bot. 51:2487–2493.

Vesicular-arbuscular mycorrhizae developed extensively in a wide range of crop plants grown in field plots and in controlled environment. At 25-28 days after sowing, generally few roots (0.6–19%) were colonized by the mycorrhizal fungus *Endogone*. The proportion of roots colonized subsequently increased rapidly to maximum levels ranging from 48 to 84%. A three-phase pattern of mycorrhizal development involving sequentially a lag phase, a phase of extensive development, and a phase of constancy in the proportion of mycorrhizal to nonmycorrhizal roots was found in bean and soybean. A similar multiphase development of mycorrhizae was evident also in some other hosts. The relationship of the different phases of mycorrhizal development to physiological changes in the host is discussed.

1959. SUZUKI, K. 1921. [Studies on the cause of purple seed of soybeans.] Chosen Agr. Assoc. Rpt. 16, pp. 24–28.

1960. SVOBODA, W. E., and J. D. PAXTON. 1972. Phytoalexin production in locally cross-protected Harosoy and Harosoy-63 soybeans. Phytopathology 62:1457–1460.

Hypocotyl tissues of 5-day-old Harosoy soybeans were cross-protected against local infection by *Phytophthora megasperma* var. *sojae* race 1 (*Pms*$_1$) by prior inocula- of the hypocotyl with a nonpathogen, *Phytophthora cactorum. P. cactorum* remained alive in the hypocotyl lesion during plant development, continuously triggering the production of phytoalexin (PA$_k$) inhibitory to the growth of the *Pms*$_1$ pathogen. The maintenance of the PA$_k$ protective mechanism against infection by *Pms*$_1$ extended to a stage of plant development in which a form of adult plant resistance may become the predominating protective mechanism. Quantitatively, the PA$_k$ reached peak concentration at six days after inoculation with *P. cactorum*; after six days, the concentration of PA$_k$ remained relatively constant. No spectrophotometrically detectable breakdown product of the PA$_k$ was found during the period studied. In the same manner, Harosoy-63 (H-63) soybean hypocotyls were cross-protected against local infection by an isolate of *P. megasperma* var. *sojae* (*Pms*) which can attack them. H-63 was cross-protected by prior inoculation of the hypocotyl with *P. megasperma* var. *sojae* race 1 (*Pms*$_1$), a nonpathogen of H-63. Pms$_1$ failed to persist in the hypocotyl of H-63 after three days. During this time, the initially induced PA$_k$ broke down, allowing *Pms* infection to develop. With the cross-protective mechanism lost, the plants died.

1961. SYDOW, H. P., and E. J. BUTLER. 1906. Fungi Indiae orientalis. I. Ann. Mycol. 4:424–445.

Records the occurrence of the teleuto-stage of *Uredo sojae* (= *Phakopsora pachyrhizi*).

1962. SYDOW, H. P., and E. J. BUTLER. 1912. Fungi Indiae orientalis. IV. [in German]. Ann. Mycol. 10:243–280.

Peronospora trifoliorum was collected on leaves in Kashmir in 1908. First report for *Glycine*. Conidia 18–24 × 16–18 μ. Oospores smooth, brown, thickwalled, 28–31 μ diameter.

1963. SYDOW, H. P., and E. J. BUTLER. 1916. Fungi Indiae orientalis. V. Ann. Mycol. 14:177–220.

This is a review of the literature containing a technical description of *Septoria sojae* n.sp. (= *S. glycines*), the causative agent of leaf spot.

1964. TACHIBANA, H., and M. SHIH. 1965. A leaf-crinkling bacterium of soybeans. Plant Dis. Reptr. 49: 396–397.

Collection and identification of diseased soybean leaves and associated organisms revealed an unreported bacterial pathogen that produced distortion and crinkling of young soybean leaflets. Such a symptom has not been reported previously for any other bacteria known to be pathogenic to soybeans. Furthermore, this pathogen produces no other symptoms used to identify the known bacterial diseases of soybeans. The causal bacterium is therefore reported as a new pathogen of the crop.

1965. TACHIBANA, H., and M. SHIH. 1965. A comparative study of three *Pseudomonas* species pathogenic to soybeans. Phytopathology 55:1079. (Abstr.)

Isolates of *Pseudomonas glycinea, P. tabaci,* and a *Pseudomonas* sp., which cause blight, wildfire, and crinkling, respectively, of soybean leaves, were compared for pathogenic, biochemical, and serological properties. Isolates of *P. glycinea* and *P. tabaci* varied in pathogenicity; some were not only more virulent than others but also differed in their virulence on different soybean cultivars and under different environmental conditions. The crinkle bacterial isolates showed no comparable pathogenic variability. *P. glycinea* differed biochemically from *P. tabaci* and the crinkle bacterium by its inability to liquefy gelatin. In serological tests, *P. tabaci* antiserum did not agglutinate *P. glycinea* or the crinkle bacterium, and the antisera of the latter two species did not agglutinate *P. tabaci.* However, antisera of *P. glycinea* and the crinkle bacterium did cross-agglutinate with their reciprocal antigens. These results demonstrate that the three *Pseudomonas* pathogens of soybeans are distinct species.

1966. TACHIBANA, H., R. B. METZER, and D. F. GRABE. 1968. Cotyledon necrosis in soybean. Plant Dis. Reptr. 52:459–462.

Cotyledonary necrosis, a noninfectious disease of soybean, is characterized by dead tissue on cotyledons of developing seedlings. The necrosis is the result of physiological deterioration of cotyledon tissues due to weathering during the period from maturity to harvest. Bacteria and fungi associated with the necrotic tissues are secondary invaders.

1967. TACHIBANA, H. 1968. *Rhizoctonia solani* root rot epidemic of soybeans in central Iowa 1967. Plant Dis. Reptr. 52:613–614.

First report of Rhizoctonia root rot epidemic. Stands were reduced by 50%. Rainfall periods followed by cooling and subsequent warming were conducive to disease. Temperatures after rainfall ranged from 26–29 C. Attacks at late stage of plant growth when pods are forming or filling causes maximum field losses.

1968. TACHIBANA, H., D. JOWETT, and W. R. FEHR. 1968. Determination of losses in soybeans caused by *Rhizoctonia solani.* Phytopathology 58:1069. (Abstr.) An abstract of entry 1970.

1969. TACHIBANA, H. 1971. Virulence of *Cephalosporium gregatum* and *Verticillium dahliae* in soybeans. Phytopathology 61:565–568.

Verticillium dahliae was isolated from diseased soybean plants and subsequently proved pathogenic to soybeans. *V. dahliae* produced vascular discolorations similar to those caused by *Cephalosporium gregatum* but did not produce typical brown stem rot symptoms caused by *C. gregatum.* Leaf symptoms produced by the two fungal pathogens were distinct. When soybean cultivars resistant and susceptible to *C. gregatum* were inoculated with *V. dahliae* they were similarly resistant and susceptible. Midwest and Ontario were the most resistant and susceptible cultivars, respectively. Average infection percentage for nine cultivars decreased from 82.9 at 18 C to 49.8 when plants were inoculated with *C. gregatum.* Infection decreased only slightly, from 97.1% at 18 C to 94.4% at 28 C, when plants were inoculated with *V. dahliae.* Average length of vascular tissue discoloration was similar at 18 and 28 C for *C. gregatum,* while plants inoculated with *V. dahliae* had slightly more discoloration at the higher temperature. Plant height reduction was greater with *V. dahliae* than with *C. gregatum*-inoculated plants.

1970. TACHIBANA, H., D. JOWETT, and W. R. FEHR. 1971. Determination of losses in soybeans caused by *Rhizoctonia solani.* Phytopathology 61:1444–1446.

A method for visually scoring disease severity was evaluated to determine losses in soybeans caused by *Rhizoctonia solani.* In different fields infected with the fungus, two cultivars, Amsoy and Hawkeye 63, were evaluated to determine whether the method was valid. Plots 3.1 m long were selected and scored for disease severities of 0, 1, 2, 3, 4, and 5 (ca. 0, 5, 15, 30, 60, and 75–100% plants killed, respectively). Data were obtained on total cm killed, total cm barren, plants killed early, mid- and late season, stand, and yield. Validity of the scoring method was indicated by absence of interaction between the cultivars or fields and the score when the data were analyzed statistically. The relationships with score were linear for 5 to 7 characters, and midseason kill generally total cm barren was not. Total plants, like cm barren, did not affect scoring; thus, both are considered inaccurate guides in visual scoring methods to determine losses from *R. solani* in soybean. Indications were that fungus is able to reduce yield as much as 48% in Amsoy and 42% in Hawkeye 63 in small plots.

1971. TACHIBANA, H., and L. C. CARD. 1972. Relationship of brown stem rot resistance to soybean mosaic virus infection in soybean. Phytopathology 62:792. (Abstr.)

Five lines of soybeans (P.I. 95.769, 90.138, 88.820N, 86.150, and 84.946-2) known to be resistant to brown stem rot (BSR), caused by *Cephalosporium gregatum,* were compared in the greenhouse for reaction to BSR with the susceptible cultivar Clark 63 and two susceptible P.I. lines (171.434 and 69-507). The BSR-resistant lines all developed dark green, mottled and ruffled leaves typical of plants infected with soybean mosaic virus (SMV), whereas the BSR-susceptible lines showed no such symptoms. The seed stocks from which the BSR-resistant lines had been taken all showed high percentages of mottled seed, an indication of SMV infection, whereas seeds of the BSR-susceptible lines had few or no mottled seeds. Leaf extracts from BSR-resistant lines induced a positive SMV reaction in the local lesion host Kentucky Wonder Wax pole beans; extracts from BSR-susceptible lines did not. Plants grown from mottled seed of a given line developed about half as much BSR as plants from nonmottled seed of the same line when artificially inoculated. The highly BSR-susceptible Ontario soybeans developed only half as much BSR when inoculated with both SMV and *C. gregatum* as when inoculated with *C. gregatum* alone.

1972. TACHIBANA, H., and L. C. CARD. 1972. Correlation coefficients between various criteria for evaluating brown stem rot resistance in soybeans. Phytopathology 62:1112. (Abstr.)

Two experiments were carried out in each of 2 years to obtain correlation coefficients (*r*) to determine the best disease criterion for selection of brown stem rot (BSR, caused by *Cephalosporium gregatum*) resistant soybeans with the highest yield potential. Percentage of plants infected vs. yield had the lowest, and percentage of stem infected vs. yield had the highest *r* values. The values for percentage stem infected vs. yield ranged from —.377 to —.582 and were always significant at the .01 probability level, whereas values for percentage plants infected ranged from —.013 to —.243 and were never statistically significant. The values for cm of stem infected without consideration of plant height ranged from —.113 to —.486 and were not always significant. Among disease criteria, all *r* values were positive and significant and ranged from .560 to .967. Significant positive correlations of .278, .412, and .459 were calculated between lodging and percentage plants infected, cm of BSR and percentage stem infected, respectively. The correlation between yield and lodging of late-maturity soybeans was —.508 and significant. Percentages of mottled seeds from two experiments were highly correlated, —.509 and —.423, with cm of BSR and percentage stem infected, respectively, in early- but not late-maturing soybeans.

1973. TACHIBANA, H., and L. C. CARD. 1972. Brown stem rot resistance and its modification by soybean mosaic virus in soybeans. Phytopathology 62:1314–1317.

Resistance to brown stem rot (BSR) was confirmed by artificial inoculations in the greenhouse. One line, P.I. 86.150, had 30% less BSR than P.I. 84.946-2, current principal source of BSR resistance for breeding purposes. Occurrence of soybean mosaic virus (SMV) in BSR-resistant lines was observed. Relationship between seed coat mottling, a symptom of SMV, and BSR resistance was inverse. When plants from nonmottled and mottled seed of BSR-susceptible Clark and resistant P.I. 84.946-2 were inoculated with *Cephalosporium gregatum,* plants from mottled seed had half as much disease as did plants from nonmottled seed. Individual and combined inoculations of SMV and *C. gregatum* in BSR-susceptible Ontario cultivar further indicated half as much BSR with both virus and fungus as with *C. gregatum* alone.

1974. TACHIBANA, H., and L. L. CARD. 1973. Effect of blending brown stem rot-resistant and -susceptible soybean lines on disease development and yield. 2nd Internatl. Cong. Plant Path. Abstr.:0432.

Having demonstrated an association between resistance to brown stem rot (BSR) and susceptibility to soybean mosaic virus (SMV), we hypothesized that BSR could be controlled by mixing low-yielding BSR-resistant (SMV-infected) lines and high-yielding BSR-susceptible (SMV-susceptible) cultivars and growing them as blends. Our hypothesis was based on the fact that SMV is naturally transmitted in the field. Seed of an advanced BSR-resistant line, selected from the cross Harosoy × P.I. 84.946-2, was mixed with seed of BSR-susceptible Corsoy in proportions of 3:1, 1:1, and 1:3, respectively. Seed coat mottling, a symptom of SMV infection, was 4.4 and 0% for the BSR-resistant line and Corsoy, respectively. The mixtures and their pure line components were planted in Latin square designs in naturally infested land at Ames and Kanawha, Iowa. Because of excessive rainfall, no effect of BSR on yield was detected at Ames, and no direct conclusion could be drawn from that location. At Kanawha, all blends showed reduced BSR symptoms and higher yields than expected solely on the basis of the different proportions of the component lines. While yields of all blends were greater than expected, only the 1:1 mixture had a statistically significant higher yield. These observations suggest that BSR can be reduced and yield increased with blends of seeds.

1975. TACHIBANA, H., and L. L. CARD. 1974. Cross protection between the virus associated with brown stem rot resistance of soybeans and other naturally occurring viruses. Proc. Amer. Phytopath. Soc. 1:37. (Abstr.)

Because practical control of brown stem rot (BSR) through use of virus-associated resistance may spread the virus and thus cause a severe virus disease problem, BSR-resistant and -susceptible soybeans were tested at potential virus problem locations in Iowa in 1973. Alternate strips of four rows of BSR-resistant lines and four rows of a susceptible cultivar of the grower's choice were planted in each of five fields by grower cooperators using

commercial equipment. Contrary to expectations, the BSR-resistant lines were less affected by viruses in the field than were the BSR-susceptible cultivars. Plants of BSR-susceptible Wayne and Calland showed severe virus symptoms at all locations. Both of these cultivars showed the severe rugose symptoms characteristic of soybean mosaic virus and the yellowing symptomatic of bean yellow mosaic virus; yellows symptoms only occurred in the BSR-resistant lines. We hypothesize that the apparent resistance of the BSR-resistant lines to soybean mosaic virus is a result of cross protection between the virus associated with BSR resistance and severe strains of closely related viruses occurring in nature.

1976. TAI, F. L., and C. T. WEI. 1933. Notes on Chinese fungi. III. Sinensia 4:83–128.

Peronospora manshurica is described as yellow or yellowish-brown, irregular, indefinite spots; sporangiophores hypophyllous, forming a brownish-violet growth, singly or in clusters from the stomata, 415–984 × 5–8 μ (common 7.6 μ in width), 5–8 times dichotomously branched; ultimate branchlets short, more or less straight, at right angles, 4–13 × 2–3 μ; sporangia broadly ellipsoidal to subglobose 19–30 × 17–26 μ, usually 23–19 μ; oospores in the dead tissue, 25–34 μ in diameter, epispore yellow, irregularly wrinkled.

1977. TAI, F. L. 1936. Notes on Chinese fungi. VII. Chinese Bot. Soc. Bull. 2, pp. 45–66.

Contains a description of *Cercospora daizu* (= *C. sojina*).

1978. TAI, F. L. 1939. Notes on Chinese fungi. IX. Lingnan Sci. J. 18:457–462.

Erysiphe glycines, a new species, is described in English and Latin. It resembles *E. polygoni* but differs in the subcylindrical asci which are 6–8 spored, usually 6. Collected in Szechwan, November 1938.

1979. TAI, F. L. 1947. Uredinales of western China. Farlowia 3:95–139.

Phakopsora pachyrhizi was collected in Yunnan and Hunan. The uredospores of the Chinese form are slightly larger and the teliospores smaller than those in the original diagnosis.

1980. TAKAHASHI, K., T. TANAKA, and K. HANDA. 1964. The mosaic and curl viruses from soybeans from the northeast area [in Japanese]. Soc. Plant Prot. N. Japan, Ann. Rpt. 15, pp. 42–44.

1981. TAKASUGI, H. 1936. Division of plant pathology and entomology [in Japanese]. Contr. Agr. Expt. Sta. Manchurian R. R., 1933, pp. 583–738.

Includes notes on the occurrence and prevalence of the following organisms on soybean: *Bacterium sojae* var. *japonicum* (= *Pseudomonas glycinea*), *Peronospora manshurica, Cercospora kikuchii, Septoria glycines, Pleosphaerulina sojaecola, Gibberella* sp., and *Cercospora sojina.*

1982. TAKIMOTO, S. 1916. Two diseases of soybean [in Japanese]. J. Plant Prot. (Tokyo) 3:368–369.

Records downy mildew and another disease due to mite injury.

1983. TAKIMOTO, S. 1921. Bacterial spotting disease of soybean [in Japanese]. J. Plant Prot. (Tokyo) 8:237–241.

A preliminary note of the entry 1984.

1984. TAKIMOTO, S. 1927. Bacterial spotting disease of soybean [in Japanese]. J. Plant Prot. (Tokyo) 14:559–566.

The disease occurred in Japan and Korea. Its causal organism is named *Bacterium sojae* var. *japonicum* n.var. (= *Pseudomonas glycinea*), and morphology and cultural characters are described in detail.

1985. TAKIMOTO, S. 1931. Leaf-scorch and leaf spotting of soybean [in Japanese]. J. Plant Prot. (Tokyo) 18:175–179.

The disease is caused by *Bacterium* (= *Xanthomonas*) *phaseoli* var. *sojense,* and *Pseudomonas glycinea* is considered a synonym.

1986. TAMADA, T., T. GOTO, I. CHIBA, and T. SUWA. 1969. Soybean dwarf, a new virus disease [in Japanese]. Ann. Phytopath. Soc. Japan 35:282–285. [In English, Rev. Plant Prot. Res. 3:89–92 (1970)].

The disease, which causes dwarfing, downward curling, rugosity and/or interveinal yellowing of the leaves, was first observed in 1952 but is now widespread in Hokkaido and responsible for considerable losses. The virus was transmitted by grafting and by *Aulacorthum solani* but not by three other aphid species or two leafhoppers, or by sap inoculation or seed. The virus was retained in the vector for 20 days. Red and white clovers proved to be symptomless carriers.

1987. TAMADA, T. 1970. Aphid transmission and host range of soybean dwarf virus. Ann. Phytopath. Soc. Japan 36:266–274.

A virus disease of soybean, characterized by a rugosity of leaves and a dwarfing of plants, has been found in Hokkaido district since about 1952. The disease causes severe damage to soybean crops. This virus, designated as soybean dwarf virus (SDV), was transmitted by the aphid *Aulacorthum solani* (Kaltenbach) but not by sap inoculation nor through seeds. Of 43 species found to be infected with the virus, all soybean cultivars tested were susceptible, though they differed in symptom expression. The aphid was able to acquire the virus by feeding on infected soybean plants for 30–60 min. and viruliferous

aphids reared on source plants could transmit the virus to healthy soybean seedlings during a period of 10–30 min. The longer the periods of acquisition and inoculation feeding, the higher was the transmission rate. The minimum latent period in the aphid vector was between 15 and 27 hr. In serial transmission tests, the aphids retained their infectivity through molting and for periods up to 21 days, but most of them lost infectivity in the later transfers. Although the transmission pattern of SDV is quite similar to that of other circulative aphid-borne viruses, SDV differs from any previously described virus on the basis of host range, symptoms, and vector species.

1988. TAMADA, T. 1973. Strains of soybean dwarfing virus [in Japanese, English summary]. Ann. Phytopath. Soc. Japan 39:27–34.

Isolates of soybean dwarf virus (SDV) obtained from naturally infected plants were divided into two groups on the basis of their symptoms on soybean plants. One group was designated as a dwarfing strain, which caused a dwarfing of plants with shortened petioles and internodes. Another group was designated as a yellowing strain, which caused a slight chlorosis of leaflets and interveinal yellowing of older leaves. In the field, soybean, pea, and white ladino clover plants were found to be infected with both strains, whereas bean plants were infected only with the yellowing strain and red clover only with the dwarfing strain. Three isolates — SDV-DS causing severe symptoms and SDV-DM mild symptoms belonging to the dwarfing strain, and SDV-Y belonging to the yellowing strain — were used as virus sources. Of 28 leguminous species inoculated by the aphid *Aulacorthum solani* (Kaltenbach), 13 species became infected with SDV-DS and 16 species with SDV-Y. In general, the symptoms caused by SDV-Y were more severe than those caused by SDV-DS on many infected plants (stunting, chlorosis, and interveinal yellowing or marginal reddening of the older leaves). The mode of transmission of SDV-Y was quite similar to that of SDV-DS.

When soybean plants were inoculated simultaneously with SDV-Y and SDV-DS or SDV-DM, the infected plants usually developed the symptoms more severely than those caused by either virus isolate alone, showing a marked rugosity of leaflets and severe stunting of plants. Plants infected doubly with SDV-DS and SDV-DM showed symptoms intermediate between these. Mixtures of these isolates could be separated by single aphid transfer to soybean plants. Soybean plants infected already with SDV-Y were not protected against infection with SDV-DS or SDV-DM, although the symptom development of SDV-DS or SDV-DM was delayed. Similarly, SDV-DS or SDV-DM also gave no protection against SDV-Y. However, SDV-DS and SDV-DM could protect against each other in soybean plants.

1989. TANAKA, T. 1921. On soybean nematode; preliminary identification [in Japanese]. J. Plant Prot. (Tokyo) 8:551–553.

Describes the morphology of *Heterodera schachtii,* with suggestions on its control.

1990. TANI, T., and N. NAITO. 1956. On the nitrogen content of plants infected with several rust fungi [in Japanese, English summary]. Kagawa Agr. Coll. (Japan) Tech. Bull. 7, pp. 141–143.

Experiments with downy mildew *Peronospora manshurica* showed that infected plants were little different from healthy ones in the N content.

1991. TARR, S. A. J. 1952. Diseases of fruit and vegetables in the Anglo-Egyptian Sudan. Sudan Min. Agr. Bull. 8. 109 pp.

Soybean is cultivated on a small scale and experimentally in many parts of the Sudan. It is often attacked by bacterial blight in the Gezira and southern Sudan. This bacterium appears to be a distinct strain and is usually termed *Xanthomonas phaseoli* var. *sojense.*

1992. TARR, S. A. J. 1955. The fungi and plant diseases of the Sudan. 127 pp.

Cercospora canescens causes leaf spotting on a wide range of leguminous plants, including soybean, in the southern and central Sudan and occurs as far north as Gezira.

1993. TASUGI, H., and S. MOGI. 1958. Resistance of soybean leaves to the scab, caused by *Sphaceloma glycines* [in Japanese, English summary]. Ann. Phytopath. Soc. Japan 23:159–164.

In inoculation tests, cultivars Norin #4 and #5, Tokachi-nagaha, and Kitami-negaha were found resistant to scab. In susceptible cultivars the young tissues are more susceptible than mature or old ones. When the susceptible cultivars are inoculated, the causal fungus penetrates into the epidermal cells of leaves, stems, and petioles by the infection peg produced from the germ tube, within 24 hr. after inoculation. The penetrated hyphae spread gradually into the palisade and spongy tissue. Within the infected cells, the decrease of chloroplasts, collapse of nucleus, and the browning and coagulation of cytoplasm are observed. In this case, the incubation period is ordinarily about a week and sporulation is seen within 2 weeks after inoculation.

On the resistant cultivars, when inoculated on young and old leaves, only the epidermal cells are invaded, and the infection is not observed generally in the palisade and spongy tissue, revealing no sign of changes in these tissues. When mature leaves are infected, however, abnormal cell divisions at the palisade tissue under the infected epidermal cells are observed, finally forming cork cambium layer. This layer consists of sclerenchymatous cells of 3–5 layers, and it seems that the mycelium of the

causal fungus can not penetrate through the layer. On the moderately resistant cultivars the occurrence of lesions and the resistance reaction of the tissue are influenced by environmental conditions and fertilizer.

1994. TAUBENHAUS, J. J. 1916. Sweet pea diseases and their control. Trans. Massachusetts Hort. Soc. 1916, pp. 131–143.

1995. TAYLOR, A. L. 1942. Root-knot resistance of five soybean varieties. Phytopathology 32:650. (Abstr.)

A method was devised and used in four experiments at three locations for testing resistance of soybean cultivars Laredo, Biloxi, Otootan, Clemson, and Georgian to the root-knot nematode, *Heterodera marioni.* Irregularities were obtained, indicating that ecological conditions were important. None of the soybean cultivars were resistant enough to use in a nematode-reducing rotation program.

1996. TAYLOR, A. L., J. FELDMESSER, and G. FASSULIOTIS. 1952. An improvement in method of searching for *Heterodera* cysts. Plant Dis. Reptr. 36:269.

The drier soil sample is mixed with water in a bucket, roiled vigorously, and allowed to settle momentarily. The supernatant fluid is then poured simultaneously through two sieves, the first with 25 meshes/in. and the second with 50 meshes/in. or finer. The process is repeated until only sand and gravel remain in the bucket. The material on the sieves is rinsed to wash all of the cysts through the first sieve and fine particles of soil and debris through the second sieve. The residue remaining on the second sieve is washed off and examined under the dissecting microscope for detection of cysts. Since the greater part of this residue is composed of fragments of plant material in various stages of decomposition and often of about the same color as the cysts, thorough examination of it requires considerable time and a certain amount of experience.

1997. TAYLOR, A. L. 1957. *Heterodera* taxonomy. Proc. S-19 Workshop Phytonematol., Univ. Tennessee, July 1–6, 1957, p. 12.

This paper studies the taxonomic status of the *Heterodera.* A review of the morphology, life history, cysts, and larvae, and a key to the species are included. A list of principal host plants of each species is given.

1998. TAYLOR, A. L. 1957. A review of the literature pertaining to the soybean-cyst nematode. U.S. Dept. Agr., Agr. Res. Serv., Nematol. Sect. 7 pp.

A review of the history, distribution, life history, host range, biology, habits, and control is presented.

1999. TAYLOR, A. L. 1962. The effect of nematicides on crop yields in the United States. Nematologica 7:16–17. (Abstr.)

From reports within the United States, the average increase in yield of soybeans where plots were treated with a nematicide was 126.1%.

2000. TAYLOR, C. F. 1944. Emergency plant disease survey in Virginia, 1943. Plant Dis. Reptr. Suppl. 148: 233–238.

Reports the occurrence of *Alternaria* sp., *Cercospora sojina, Phyllosticta glycineum* (= *P. sojaecola*), and *Xanthomonas phaseoli* var. *sojense* on soybean.

2001. TAYLOR, C. F. 1944. Emergency plant disease survey in West Virginia in 1943. Plant Dis. Reptr. Suppl. 148:239–294.

Reports the occurrence of *Xanthomonas phaseoli* var. *sojense* on soybean.

2002. TAYLOR, D. P. 1957. Plant-parasitic nematodes: A threat to Minnesota crops. Minnesota Farm and Home Sci. 14(3):5, 9.

The lance and spiral nematodes have been found in large numbers on soybeans in Minnesota.

2003. TAYLOR, D. P., R. V. ANDERSON, and W. A. HAGLUND. 1958. Nematodes associated with Minnesota crops. I. Preliminary survey of nematodes associated with alfalfa, flax, peas, and soybeans. Plant Dis. Reptr. 42:195–198.

The following nematodes were found associated with soybeans in Minnesota: *Aphelenchoides* spp., *Aphelenchus* spp., *Ditylenchus* spp., *Helicotylenchus* spp., *H. erythrinae, H. nannus, Heterodera* spp., *H. cacti* group, *Hoplolaimus coronatus, Boleodorus* spp., *Neotylenchus* spp., *Paratylenchus* spp., *Pratylenchus* spp., *P. hexincisus, P. penetrans, P. pratensis, P. scribneri, Psilenchus* spp., *Rotylenchus robustus, Trichodorus* spp., *Tylenchorhynchus* spp., *T. acutus, T. latus, T. maximus, T. nudus, T. straitus, Tylenchus* spp., and *Xiphinema americanum.* Nematodes in the genera *Helicotylenchus, Tylenchorhynchus, Paratylenchus,* and *Pratylenchus* were the most frequently recovered.

2004. TAYLOR, D. P., and T. D. WYLLIE. 1959. Interrelationship of root knot nematodes and *Rhizoctonia solani* on soybean emergence. Phytopathology 49:552. (Abstr.)

The effect of *Meloidogyne javanica* and *M. hapla* alone and in combination with *Rhizoctonia solani* on preemergence damping-off of Chippewa soybeans was determined in tests at 75 F in the greenhouse. Check treatments included noninoculated pots and pots containing each parasite alone. Steamed soil was inoculated with *R. solani* before seeds were planted, and with a suspension of eggs and larvae of nematodes at time of planting. Three weeks after planting, the average emergence for each treatment, expressed as a percentage of the check,

was: *M. javanica* alone, 98%; *M. hapla* alone, 83%; *R. solani* alone, 50%; *M. javanica* plus *R. solani*, 17%; and *M. hapla* plus *R. solani*, 2%.

2005. TAYLOR, D. P. 1960. Biology and host-parasite relationships of the spiral nematode, *Helicotylenchus microlobus*. Diss. Abstr. 21:721–722.

Eight species of the genus *Helicotylenchus* were identified in 46% of 810 soil samples collected in 1956–1959 throughout Minnesota. Members of this genus had the highest frequency of occurrence in the southern, central, and west central districts of the state. Rye, corn, wheat, oats, soybean, and flax were the crops with which *Helicotylenchus* spp. were most frequently associated.

2006. TAYLOR, D. P. 1960. Host range study of the spiral nematode, *Helicotylenchus microlobus*. Plant Dis. Reptr. 44:747–750.

In greenhouse pot tests, the following soybean cultivars supported population increases of *Helicotylenchus microlobus* three months after inoculation: Acme, Blackhawk, Capital, Chippewa, Comet, Earlyana, Flambeau, Grant, Harosoy, Monroe, Norchief, and Ottawa Mandarin.

2007. TAYLOR, D. P. 1961. Biology and host-parasite relationships of the spiral nematode, *Helicotylenchus microlobus*. Proc. Helminth. Soc. Washington 28:60–66.

Helicotylenchus microlobus produced light- to dark-brown lesions on soybean roots. The lesions involved 4–10 epidermal cells and could not be observed to extend more than four cells into the cortex. In about one-third of the lesions observed, the anterior end of *H. microlobus* was embedded in the root. Endoparasitism was not observed in soybean roots as it was in other host plants.

2008. TAYLOR, D. P. 1961. Nematodes can make soil-borne diseases worse. Minnesota Farm and Home Sci. 18(3):10, 17.

A popular article. In soybean experiments where the fungus *Rhizoctonia solani* and nematodes *Meloidogyne hapla* and *M. incognita* alone and the fungus and nematodes in combination were used, the following results were obtained: (1) emergence of soybeans was drastically reduced when the fungus and nematodes were used in combination, and (2) retardation in growth and post-emergence death of plants were greater when the fungus and nematodes were used in combination.

2009. TAYLOR, D. P., D. I. EDWARDS, and R. B. MALEK. 1968. The soybean-cyst nematode spreads through southern Illinois. Illinois Res. Fall 1968.

A popular article. A general explanation is given of the cyst nematode situation in Illinois, with suggestions for rotations, resistant cultivars, and chemical control.

2010. TAYLOR, D. P. 1969. Soybean cyst nematode. Soybean Farmer (May 1969):14–15, 22.

A popular article. Extent of infestations and control measures for 10 states with infestations of the soybean-cyst nematode are summarized.

2011. TAYLOR, D. P., R. B. MALEK, and D. I. EDWARDS. 1971. The barley root-knot nematode: it's not a problem — yet. Crops and Soils 23(6):14–16.

A popular article. *Meloidogyne naasi* was reproduced and caused galling on soybean roots but it was not determined whether this nematode could cause reductions in yield. Symptoms and control of disease, and biology and host range of nematode are briefly described.

2012. TAYLOR, P. L., J. M. FERRIS, and V. R. FERRIS. 1968. Quantitative evaluation of the effect of *Pratylenchus penetrans* on root development of seedlings soybeans under defined conditions. Nematologica 14:17. (Abstr.)

Diagnostic parameters for determining extent of injury to seedling soybeans by *Pratylenchus penetrans* under defined conditions have been established at three temperatures — 16, 21, and 27 C. Nematodes for these tests were grown on alfalfa callus tissue. Surface-sterilized soybean seeds (cultivar Clark 63) were germinated and seedlings grown aseptically in autoclaved transparent growth pouches. Parameters used to assess damage in two tests at each temperature were: root weight, tap root length, number of lateral roots, length of longest lateral, and number of laterals in successive zones of the tap root. Nematode infection caused a reduction in size of root system and produced typical brown lesions. In both tests at 21 C, *P. penetrans* reduced the mean total root weight of inoculated seedlings ($x = 0.41$ and 0.50 g) by almost half as compared to noninoculated seedlings ($x = 0.70$ and 0.89 g). Tap root length of the control plants ($x = 16.4$ and 20.7 cm) was significantly greater than that of the inoculated plants ($x = 10.5$ and 10.5 cm) in both tests. Control plants averaged twice as many lateral roots (54 and 70) as the nematode-infested seedlings (28 and 32), and length of the longest lateral was reduced an average of 6.0 and 12.2 cm in the two tests. All differences at 21 C were highly significant ($P < 1\%$).

At 16 C root growth was generally suppressed in both control and inoculated plants, and thus the mean differences in total root weight between control and inoculated seedlings were less than at 21 C. In one test at 16 C, the root weight of inoculated seedlings ($x = 0.20$ g) was significantly less ($P < 5\%$) than that of noninoculated seedlings ($x = 0.24$ g) whereas there was no significant difference in root weight ($x = 0.27$ g vs 0.25 g) in the second test. At 16 C *P. penetrans* caused a highly significant reduction in total number of lateral roots, from a mean of 20 for control plants to 16 for inoculated plants in one test, and from 24 to 18 in the second test. The mean tap root lengths of the control seedlings were 8.7 and 9.8 cm in the two tests at 16 C, whereas the tap roots of the inoculated plants were much shorter ($x =$

6.4 and 7.1 cm, respectively, $P < 1\%$). Although the differences in length of the longest laterals were small, 8.7 and 9.8 cm for the control vs. 6.4 and 7.1 cm for the inoculated plants, these differences were highly significant.

At 27 C the seedlings grew rapidly but nematode injury was still severe. The reduction in root weight by nematodes in one test was significant with a mean of 0.48 g for controls vs. 0.36 g for inoculated seedlings, and in the second test was highly significant with a mean of 0.85 g for controls vs. 0.68 for inoculated seedlings. Tap root length was reduced ($P < 1\%$) by nematode injury from a mean of 21.5 cm in the checks to 9.2 cm in the inoculated plants in one test, and from 28.6 cm to 12.0 cm in the other test. In both tests the nematodes decreased the total number of lateral roots about 60% below the number present on noninoculated plants (36 vs. 83 and 45 vs. 120). Length of the longest lateral was reduced ($P < 1\%$) an average of 8.8 cm and 13.9 cm in the two tests. Bivariate product moment correlation coefficients between root weight and the other parameters were determined for values obtained at all three temperatures. Highly significant r values indicated that root weight was directly correlated with the other parameters in nearly every instance in injured plants, though not as consistently in vigorously growing control plants.

2013. TAYLOR, P. L., J. M. FERRIS, and V. R. FERRIS. 1973. Technique for quantifying injury to seedling soybeans by *Pratylenchus penetrans* without sacrificing the plant. J. Nematol. 5:68–69.

Surface-sterilized seeds are planted with hilum down in a growth pouch (4 seeds/pouch) over holes punched in the paper trough. The pouches are then placed at 25–27 C until the germinating root is 0.5–3 cm long, nongerminated seeds are replaced with germinated ones, and 1,000–4,000 *Pratylenchus penetrans* in water suspension are added per pouch. Pouches are incubated at 21 C with 16-hr. photoperiod for 9–12 days. Growth reduction of root system, tap root length, length of longest lateral root, and total number of lateral roots, are criteria for disease rating.

2014. TEAKLE, D. S. 1962. Necrotic symptoms of tobacco necrosis virus in roots. Phytopathology 52:1037–1040.

Root lesions or root necrosis occurred on soybeans when a suspension of *Olpidium* zoospore and tobacco necrosis virus were applied simultaneously, with root abrasion, in soil or in petri dishes.

2015. TEHON, L. R., and E. Y. DANIELS. 1927. Notes on parasite fungi of Illinois. Mycologia 19:110–129.

Phyllosticta glycineum (= *P. sojaecola*), described as a new species, produced subcircular, cinereous spots with purple margins on soybean leaves. The pycnidia of the fungus are globose or somewhat applanate, 90–170 μ in diameter, immersed, with a slightly protruding ostiole 10–20 μ wide; the spores are oblong with rounded ends, aseptate, hyaline to smoky gray, 2–2.5 $\times$ 4.5–7 μ.

2016. TEHON, L. R., and G. H. BOEWE. 1939. Charcoal rot in Illinois. Plant Dis. Reptr. 23:312–325.

Charcoal rot disease was found on soybeans.

2017. TENNE, F. D., C. PRASARTSEE, C. C. MACHADO, and J. B. SINCLAIR. 1974. Variation in germination and seedborne pathogens among soybean seed lots from three regions in Illinois. Plant Dis. Reptr. 58:411–413.

Amsoy and Wayne soybean seed lots harvested in 1972 from north, central, and southern regions of Illinois were assayed for internally borne fungi and bacteria. Percentage germination, total fungi, *Diaporthe phaseolorum* var. *sojae,* and *Pseudomonas* sp. differed significantly among the seed lots between regions for Wayne, but not for Amsoy. There was a high correlation between occurrence of *Pseudomonas* sp., total fungi, *Diaporthe phaseolorum* var. *sojae,* and percentage germination among lots of both cultivars.

2018. TENNE, F. D., and J. B. SINCLAIR. 1974. Detection of internally-borne *Pseudomonas glycinea* in soybean seeds at high temperatures. Proc. Amer. Phytopath. Soc. 1:130. (Abstr.)

Pseudomonas glycinea, causal agent of bacterial blight of soybean, when internally seedborne in soybean can reduce germination, emergence, and thus seed quality. Bioassay techniques for presence of *P. glycinea* in surface-sterilized seeds used a temperature range of 20–35 C. Varying degrees of association of *P. glycinea* with different cultivars from various locations have been established. Surface-sterilized seeds of the cultivars Hark, Kent, Hill, and Lee bioassayed at temperatures of 25, 30, 35, 40, 45, and 50 C showed an increase in percentage occurrence of *P. glycinea* with increase in temperature. At 40 C all seeds were decayed (no germination) by either rough- or smooth-margined colonies of bacteria characteristic of *P. glycinea.* Whether *P. glycinea* can be considered strictly as a parasite or a saprophyte under high-temperature incubation is discussed.

2019. TERVET, I. W. 1943. Molds injurious to soybean seed. Minnesota Farm and Home Sci. 1:13–14.

Severe retardation in seedling growth resulted from storage conditions favoring the development of *Aspergillus* spp., but seed treatment with maximum adhesive load of arasan improved the vigor and stand of plants.

2020. TERVET, I. W. 1943. Soybean diseases in Minnesota. Plant Dis. Reptr. 27:135–138.

Records the occurrence and prevalence of *Pseudomonas glycinea, Fusarium* sp., *Rhizoctonia* sp., and mosaic

virus. Results of varietal trials for resistance to mosaic virus and *P. glycinea* are given. There was no clear evidence that seed treatment with spergon or new improved semasan controlled any of the seedborne diseases.

2021. TERVET, I. W. 1943. Plant disease surveys in Minnesota and the Dakotas. Plant Dis. Reptr. 27:373–375.

Records the occurrence of *Xanthomonas phaseoli* var. *sojense* and mosaic virus in Minnesota.

2022. TERVET, I. W. 1944. Diseases in South Dakota in 1943. Plant Dis. Reptr. Suppl. 149:308–311.

Records the occurrence of bacterial pustule (*Xanthomonas phaseoli* var. *sojense*) on soybeans.

2023. TERVET, I. W. 1944. Diseases of soybeans in Minnesota. Plant Dis. Reptr. 28:687.

In soybean fields examined in the vegetable-growing area in Ramsey, infection of *Xanthomonas phaseoli* var. *sojense* is heavier than in 1943. Mosaic virus can be found readily in all plantings of vegetable cultivars.

2024. TERVET, I. W. 1944. Soybean diseases in Minnesota. Plant Dis. Reptr. 28:835.

Records the occurrence and prevalence of *Xanthomonas phaseoli* var. *sojense, Pseudomonas glycinea,* tobacco ring spot virus, mosaic virus, and a root rot of undetermined cause.

2025. TERVET, I. W. 1945. The influence of fungi on storage, on seed viability and seedling vigor of soybeans. Phytopathology 35:3–15.

Species of *Alternaria* were the most frequent occupants of soybean seed samples in Minnesota, followed by *Fusarium* spp. The incidence of damage by microorganisms increased in proportion to the extent of frost injury. Other fungi found in seeds of high moisture content included: *Aspergillus glaucus, A. flavus, A. ochraceus, A. niger, A. fumigatus, Chaetomium* sp., *Cephalothecium roseum, Cunninghamella echinulata, Rhizopus nigricans,* and *Penicillium* sp. *Aspergillus flavus* was the species predominantly concerned in retardation of seedling growth. Arasan treatment improved the vigor of seedlings and increased the stand.

2026. TERVET, I. W., and C. T. TSIANG. 1946. Pathogenicity of isolates of *Rhizoctonia solani* on soybean. Phytopathology 36:411.

Ten cultivars of soybean were inoculated with eight isolates of *Rhizoctonia solani* in steamed soil in the greenhouse at 70 F. The isolates differed considerably in virulence and the soybean cultivars differed greatly in susceptibility. One isolate from sweet clover was strongly pathogenic on most cultivars. It caused severe pre-emergence killing in cultivars Bansei and Taystee but relatively little in cultivars Habaro and Kabbott, although severe stem lesions eventually developed on most plants and there was considerable rotting of tap roots and laterals. Isolates from flax and sugar beets were less virulent than the sweet clover isolates, although they caused poor stands of Bansei and Taystee. Plants with cotyledons rotted away to leave bald-head seedlings were not uncommon in all cultivars planted in inoculated soil. Such abnormal seedlings were rarely found in steamed soil. Although isolates of *R. solani* differed decidedly in virulence, there was no evidence of race-host specificity. Cultivars of soybean differed in their susceptibility but all were attacked more severely by strongly pathogenic races of *R. solani* than by weaker isolates. Host reaction, as used in separation of races of rust and smuts, is not applicable to a fungus such as *R. solani.*

2027. THAPLIYAL, P. N., and J. B. SINCLAIR. 1970. Uptake of three systemic fungicides by germinating soybean seed. Phytopathology 60:1373–1375.

Soybean seed were either nontreated or treated with benomyl, chloroneb, and carboxin at 0.125, 0.25, or 0.5 g/100 g (2, 4, or 8 oz./100 lb.). Uptake was demonstrated by bioassay of extracts from germinating seed using an isolate of *Rhizoctonia solani* sensitive to the three fungicides. Benomyl, or a compound related to it, becomes localized in the cotyledons.

2027a. THAPLIYAL, P. N., and J. B. SINCLAIR. 1970. Uptake and distribution of three systemic fungicides in soybean seedlings. Proc. 7th Internatl. Cong. Plant Prot. (Paris), p. 735. (Abstr.)

When extracts from cotyledons and hypocotyl tissues of benomyl- and chloroneb-treated seed were bioassayed separately, little or no activity was noted from hypocotyl extracts at any exposure time or at any rate. However, significantly greater inhibition of fungus growth was noted by extracts from cotyledons of treated seed than from nontreated seed. These results suggest that benomyl and chloroneb, or compounds related to them, become localized in the cotyledons and may not move systemically into other seedling tissues. These results may explain, in part, the general lack of success by us and others in increasing soybean stands using benomyl and chloroneb. In contrast, when extracts from cotyledons and hypocotyl tissues of carboxin-treated seedlings were bioassayed separately, there was an increase in growth inhibition of the test fungus as treatment rate and exposure time were increased in both cotyledonary and hypocotyl tissues. Carboxin, or a compound related to it, appeared to be translocated from the cotyledonary tissue into hypocotyl tissue of soybean seedlings.

2028. THAPLIYAL, P. N., and J. B. SINCLAIR. 1971. Translocation of benomyl, carboxin, and chloroneb in soybean seedlings. Phytopathology 61:1301–1302.

Use of ^{14}C-labeled and nonlabeled fungicides as seed treatments of soybean showed that benomyl and chloro-

neb initially tended to localize in cotyledons, while carboxin did not. At 4 days after treatment, chloroneb was redistributed into the hypocotyl and cotyledons, whereas benomyl moved only into the epicotyl. Carboxin was distributed uniformly throughout the seedling, with higher concentrations in the epicotyl.

2029. THAPLIYAL, P. N., and K. P. SINGH. 1974. Soybean (*Glycine max*) rust *Phakopsora pachyrhizi*. Amer. Phytopath. Soc. Fungicide and Nematicide Tests, Results of 1973. 29:94.

Soybean rust caused by *Phakopsora pachyrhizi* Syd. is one of the most destructive diseases of soybean. The disease appeared for the first time in India in September/October 1970 in a very severe form affecting almost all soybean cultivars grown at the crop research center at Pantnagar, Nainital (U.P.), where field trials for chemical control of the disease were conducted using soybean cultivar Bragg. Efficacy of several fungicides, as a combination of seed and spray treatment, was tested. The seed treatment subplots consisted of two rates (0.125% and 0.25%) of benomyl and plantvax, and sprays as mainplots included dithane M-45, dithane Z-78, benomyl, and plantvax. Applications were started just after the first pustules were observed in the field (about 60 days after sowing). Each chemical was sprayed three times during the season. The systemic fungicides (benomyl and plantvax) were applied at 15-day intervals, whereas nonsystemic fungicides (dithane M-45, dithane Z-78) were repeated at 10-day intervals. Among the four fungicides used as sprays, all except plantvax showed significant yield increases. Dithane M-45 and dithane Z-78 were best, followed by benomyl. Plantvax, reported effective against many rust diseases, was found ineffective at the rate used in this trial. Plantvax and benomyl as seed treatments at both the rates were found effective. However, interaction between sprays and seed treatments was nonsignificant. The thousand-grain weight analysis revealed nonsignificant differences.

In another trial, effectiveness of three fungicides (dithane M-45, brestanol, and difolatan) with and without sticker (sandovit) was tested. The first spray was applied on September 25 when the first pustules were seen (60 days after planting). The remaining two sprays were applied at 10-day intervals. Dithane M-45, both with and without sticker, was most effective, followed by brestanol and difolatan. A combination of the sticker (sandovit) with brestanol resulted in a significant reduction in yield as compared with that obtained from brestanol alone, indicating a possible antagonistic interaction. Sandovit (sticker) alone showed some yield increase as compared to the check. Thousand-grain weight analysis proved to be nonsignificant.

2030. THAPLIYAL, P. N., and B. C. MISRA. 1974. Soybean (*Glycine max*) bacterial pustule, *Xanthomonas phaseoli* var. *sojense*. Amer. Phytopath. Soc. and Nematicide Tests, Results of 1973. 29:147.

A field trial was conducted using soybean cultivar Improved Pelican, known to be susceptible to the pathogen causing bacterial pustule disease. The treatments consisted of seed treatment with ceresan-dry, vitavax, thiram (control), and hot water treatment (56 C for 10 min.) and spraying of fytolan, duter, and kocide 101. The sixteen treatment combinations (all possible combinations of four seed and four spray treatments) were tested in a randomized block design with three replications each. Sprayings were given at 15-day intervals, the first when plants were 45 days old. Data on emergence were recorded 1 month after sowing. Disease incidence was recorded on the fortieth day after planting. The effect on yield and thousand-grain weight was also recorded. All plots had fairly high incidence of the disease. Hot-water treatment resulted in poor seedling emergence, indicating a deleterious effect of the temperature and duration combination on soybean seed. Differences in disease incidence in different treatment plots as recorded on the fortieth day were nonsignificant. However, significant differences were recorded 80 days after planting. Combination of fytolan spray and seed treatment with ceresan, hot water, or thiram and also of duter spray with vitavax seed treatment resulted in significantly lower disease incidence. Vitavax seed treatment with duter spray gave significantly higher yield and 1,000-grain weight also, whereas hot-water seed treatment with kocide 101 spray resulted in significantly higher 1,000-grain weight only.

2031. THIRUMALACHAR, M. J., and C. CHUPP. 1948. Notes on some *Cercospora* of India. Mycologia 40:352–362.

Cercospora sojina was collected on leaves of *Glycine javanica* L. in August 1945 at Bangalore, Mysore state, India, at an altitude of about 3,000 ft. Annual rainfall was about 30 in.

2032. THIRUMALACHAR, M. J., M. K. PATEL, N. B. KULKARNI, and G. W. DHANDE. 1956. Effects in vitro of some antibiotics on thirty-two *Xanthomonas* species occurring in India. Phytopathology 46:486–488.

Aureomycin, terramycin, streptomycin, and chlorophenicol, each at the rate of 60 μg/ml, inhibited the growth of *Xanthomonas phaseoli* var. *sojense* in vitro.

2033. THOMAS, H. R., and W. J. ZAUMEYER. 1950. Red node, a virus disease of bean. Phytopathology 40: 28–29. (Abstr.)

An abstract of entry 2034.

2034. THOMAS, H. R., and W. J. ZAUMEYER. 1950. Red node, a virus disease of beans. Phytopathology 40:832–846.

Soybean cultivars Lincoln and Burdette developed systemic necrosis symptoms and died when inoculated with red node or streak viruses. Arksoy, Ralsoy, Illini, and Gibson developed less intense systemic necrosis and were not killed. Biloxi and Cherokee developed systemic necrosis and died when inoculated with red node virus, whereas others showed only veinal necrosis of leaves inoculated with tobacco streak virus. Arksoy developed stem necrosis when inoculated with either virus, but streak viruses also resulted in stunting and mottling. CNS developed stunting and mottling when inoculated with red node virus, but systemic infection resulting in death occurred with streak virus. Red node virus is related to tobacco streak virus.

2035. THOMAS, H. R. 1951. Yellow dot, a virus disease of bean. Phytopathology 41:967–974.

Yellow dot virus, a strain of bean mosaic virus, infected soybeans upon inoculation.

2036. THOMAS, H. R., and W. J. ZAUMEYER. 1953. A strain of yellow bean mosaic virus producing local lesions on tobacco. Phytopathology 43:11–15.

The virus caused severe mottling on inoculated soybean cultivars Patoka and Blackhawk.

2037. THOMPSON, A. 1928. Report of the mycologist. *In* Annual reports for 1927 of heads of divisions of the department of agriculture, Federated Malaya States and Straits Settlements. Malayan Agr. J. 16:161–168.

Sclerotium rolfsii was recorded in Malaya.

2038. THOMPSON, A., and A. JOHNSTON. 1953. A host list of plant diseases in Malaya. Commonw. Mycol. Inst., Mycol. Papers 52. 38 pp.

Cites the occurrence on soybean of *Corticium solani,* collar rot; *Mycosphaerella* sp., leaf spot; and *Sclerotium rolfsii,* wilt.

2039. THOMPSON, T. B., K. L. ATHOW, and F. A. LAVIOLETTE. 1971. The effect of temperature on the pathogenicity of *Pythium aphanidermatum, P. debaryanum,* and *P. ultimum* on soybean. Phytopathology 61: 933–935.

Pythium aphanidermatum, P. debaryanum, and *P. ultimum* were all pathogenic to soybeans. Three methods of inoculation were used: (1) placing a small piece of mycelium in an incision in the hypocotyl, (2) pouring macerated mycelium over seed in the soil, and (3) placing seeds on agar overgrown with the fungi. All three techniques led to infection except when inoculum of *P. aphanidermatum* was poured over seeds in soil. Temperature had a differential effect on severity of disease incited by these fungi. *P. aphanidermatum* infected soybean between 24 and 26 C, while *P. debaryanum* and *P. ultimum* were more virulent at 15 or 20 C or after preconditioning at 4, 8, or 12 C more than 4 days.

2040. THORNBERRY, H. H., and H. W. ANDERSON. 1940. Pink-root disease of onion and tomatoes. Plant Dis. Reptr. 24:383–384.

Soybean was found to be a host of *Phoma terrestris.*

2041. THREINEN, J. T., T. KOMMEDAHL, and R. J. KLUG. 1959. Hybridization between radiation-induced mutants of two varieties of *Diaporthe phaseolorum.* Phytopathology 49:797–801.

Separation of *Diaporthe phaseolorum* into two varieties on the basis of morphological differences in culture or pathogenicity on soybeans is considered invalid. Nonsporulating mutants of both varieties resulted from irradiation. Self-sterile mutants of the var. *caulivora* behaved in crosses with parent types of both varieties as if heterothallic, indicating that homothallism ascribed to the var. *caulivora* is not a constant character. Mutants of var. *caulivora* crossed with the var. *sojae* produced perithecia that had the morphological characters of var. *sojae.* Most mutants were less pathogenic than the parents on soybean; some were equally pathogenic. Mutants of the var. *caulivora* produced symptoms on soybeans that were indistinguishable from symptoms produced by the var. *sojae,* making this an unreliable character for varietal separation.

2042. THUNG, T. H., and T. HADIWIDJAJA. 1957. [Witches broom disease in the Leguminosae.] Tiydschr. Pl. Uekt. 63:58–63.

Witch's broom virus disease was studied on many legumes, including soybeans, in Java.

2043. TIDD, J. S. 1944. Bud blight, wildfire, and other diseases in Illinois. Plant Dis. Reptr. 28:890.

Records the occurrence of *Peronospora manshurica, Pseudomonas glycinea, P. tabaci, Septoria glycines, Alternaria atrans* (leaf spot), bud blight (tobacco ring spot virus) *Xanthomonas phaseoli* var. *sojense,* and *Sclerotium bataticola* (= *Macrophomina phaseolina*).

2044. TIDD, J. S. 1944. Bud blight in Indiana. Plant Dis. Reptr. 28:891. [Published title reads "Wild fire in Indiana." Corrected as above.]

Records 100% of plants infected with tobacco ring spot virus in a field of Indiana.

2045. TIDD, J. S. 1944. Soybean diseases in Indiana and Illinois. Plant Dis. Reptr. 28:957–958.

Records the prevalence of the following pathogens on soybeans: *Peronospora manshurica, Diaporthe sojae* (= *D. phaseolorum* var. *sojae*), *Macrophomina phaseolina, Rhizoctonia solani, Fusarium oxysporum* f. *tracheiphilum, Pseudomonas glycinea, Xanthomonas phaseoli* var. *sojense,* and tobacco ring spot virus.

2046. TIFFANY, L. H. 1951. The anthracnose complex on soybeans. Iowa State Coll. J. Sci. 25:371–372.

Summary of doctoral thesis, reporting that *Colletotrichum truncatum* (= *C. dematium* f. *truncata*), *C. destructivum,* and *Glomerella glycines* commonly cause anthracnose of soybeans in Iowa. Seedborne inoculum may bring about the symptomless establishment of internal mycelium as well as pre-emergence killing and seedling blight. Cross-inoculations were made with these and other anthracnose fungi occurring on common legumes. Red clover, soybean, alfalfa, and sweet clover were susceptible to *C. trifolii, C. destructivum, C. truncatum,* and *C. graminicola.* The conidial stage of *G. glycines* is not *C. glycines,* but a straight-spored form similar to *C. destructivum.*

2047. TIFFANY, L. H. 1951. Delayed sporulation of *Colletotrichum* on soybean. Phytopathology 41:975–985.

Seedborne inoculum of *Colletotrichum truncatum* (= *C. dematium* f. *truncata*) was responsible for three types of infection on soybean: (1) pre-emergence killing, (2) seedling blight, and (3) symptomless establishment of internal mycelium. The third type was investigated in detail. Mycelium from infected cotyledons became established in the cortical cells of the stem without apparent effect on them and remained localized in the immediate stem area until flowering time. It then resumed growth and penetrated the lower stem, petioles, leaves, and developing seeds and pods, without the immediate development of disease symptoms. At the host's maturity under proper environmental conditions, the fungus may fruit abundantly on stems and pods.

2048. TIFFANY, L. H., and J. C. GILMAN. 1954. Species of *Colletotrichum* from legumes. Mycologia 46: 52–75.

Successful cross-inoculations with cultures of *Colletotrichum truncatum* from lima bean were made on soybean, alfalfa, sweet clover, lima bean, and pea. Inoculations with the soybean isolates caused a rapid breakdown of the tissues of alfalfa, sweet clover, and red clover, and infected soybean, lespedeza, ladino clover, bird's foot trefoil, lima bean, and pea. The soybean isolate was isolated from green plants of various species, none of which showed any disease. *C. truncatum* (= *C. dematium* f. *truncata*) compared with *Vermicularia truncata, V. polytricha, C. caulivorum,* and *C. glycines.* All were found identical and hence were reduced to synonym level of *C. truncatum.*

2049. TIKHONOV, O. I., and M. V. KRASNOVA. 1965. [The resistance of varieties and hybrids of soybean to bacterioses.] Selekts. Semenov. 30(2):59.

In 1960 there were 2,500 hybrids and cultivars tested under nature conditions. Relatively resistant to several general complexes of bacterioses were Kubanskaya 4958, Kharbinskaya 111, and 1044/57; to cotyledon bacteriosis, Kormovaya 28, Kubanskaya 276, Nepolegayushchaya 2, VNIIMK 8012, the lines and hybrids 30/58, 115-53, 643/59, 263/55, 439/57, 272/58 No. 24, and selections from VNIISK 3 and Kubanskaya 4958; to *Xanthomonas phaseoli,* VNIIMK 9186 and Nepolegayushchaya 2; to *Pseudomonas glycinea,* Polukul'turnaya × 276, Minsoi, Kubanskaya 276 × VNIIMK 9186, and 178/54 × Samai 216. No. 25 705/59 was not attacked at all, while VNIISK 2 and 1318/60 were resistant to cotyledon bacteriosis, *P. glycinea,* and *X. phaseoli.*

2050. TIMNICK, M. B., V. G. LILLY, and H. L. BARNETT. 1948. The influence of light and other factors upon the sporulation of *Diaporthe phaseoli* from soybean. Amer. J. Bot. 35:804.

On vegetable juice agar, only pycnidia were formed. Few perithecia formed on vitamin-free casein hydrolysate medium unless cultures were irradiated with ultraviolet light. Exposure of cultures to continuous illumination from a daylight fluorescent tube for 60 days allowed the development of abundant perithecia, but almost completely inhibited the formation of asci and ascospores.

2051. TIMNICK, M. B., V. G. LILLY, and H. L. BARNETT. 1951. Factors affecting sporulation of *Diaporthe phaseolorum* var. *batatatis* from soybean. Phytopathology 41:327–336.

The study has shown that *Diaporthe phaseolorum* var. *batatatis* (= *caulivora*) is partially deficient for inositol and that the effect of inositol and other vitamins on sporulation varied with source of carbon in the medium. Production of stromata and perithecia occurred on synthetic media solidified with agar, as well as on soybean stems and pods, although the natural-host media permitted greater numbers of perithecia to form, in a shorter period of time. Ultraviolet irradiation either stimulated or inhibited the formation of perithecia, depending on the medium used. Maximum production of ascospores occurred when cultures received periods of both light and darkness. Continuous total darkness was unfavorable for the formation of perithecia. Small separate pycnidia containing almost entirely beta spores were found on most media, and their production on certain media was increased by exposure to ultraviolet irradiation. They failed to form in continuous darkness. Alpha spores were produced in abundance only on soybean stems and pods.

2051a. TINGEY, D. T., R. A. REINERT, and H. B. CARTER. 1972. Soybean cultivars: acute foliar response to ozone. Crop Sci. 12:268–270.

2052. TINGEY, D. T., R. C. FITES, and C. WICKLIFF. 1973. Ozone alteration of nitrate reduction in soybean. Physiol. Plant 29:33–38.

Soybeans were harvested at various periods after a 2-hr. exposure to determine the effects of ozone on nitrate reductase and selected metabolites related to nitrate reduction. Ozone initially depressed the concentrations of reducing sugars and amino acids and nitrate reductase

activity. On subsequent days following exposure, amino acid and protein levels were higher than the respective controls, while the levels of reducing sugars and nitrate reductase activity returned to control levels. The ozone depression of nitrate reduction was not the result of a direct ozone reaction with the nitrate protein but rather an interference with reactions that supplied the NAD-(P)H needed for nitrate reduction.

2053. TINGEY, D. T., and U. BLUM. 1973. Effects of ozone on soybean nodules. J. Environ. Qual. 2:341–342.

Soybeans were exposed to ozone to determine if plant growth and nodulation would be reduced. The plants were 3 weeks of age when exposed to ozone for 1 hr. and were harvested at weekly intervals starting 4 days after exposure. The ozone exposure caused only transitor reduction in fresh weight. However, nodule number, weight per plant, leghemoglobin content, and root growth were consistently reduced. The reduction in nodule weight per plant and leghemoglobin control per plant were directly correlated with reduction in nodule number.

2054. TINGEY, D. T., R. A. REINERT, C. WICKLIFF, and W. W. HECK. 1973. Chronic ozone or sulfure dioxide exposure or both, affect the early vegetative growth of soybean. Canad. J. Plant Sci. 53:875–879.

Soybean cultivars Hood and Dare were exposed to low O_3 or SO_2 concentrations (or both) during the first 3 weeks of growth. Foliar injury occurred on both cultivars in O_3 and in the mixture. Dare developed more foliar injury than Hood. Plant height, top and root fresh and dry weights, and the dry shoot:root ratios were significantly reduced by 10 pphm O_3. The mixture of 5 pphm O_3 + 5 pphm SO_2 significantly reduced top fresh weight, root fresh and dry weights, and shoot:root ratios. Treatments of 5 pphm O_3 or SO_2 or 20 pphm SO_2 had no significant effect on plant growth. The growth reductions resulting from the mixture were greater than the additive ones of the single gases. The absence of significant cultivar × treatment interaction indicated that growth of both cultivars responded similarly to the treatments.

2055. TISDALE, W. H. 1921. Two sclerotium diseases of rice. J. Agr. Res. 21:649–657.

Slight morphological differences were noticed among isolates of *Sclerotium rolfsii* from soybean, wheat, and *Arrhenatherum elatius.*

2056. TOCHINAI, Y., and I. HARA. 1944. A list of parasitic fungi collected in the territory of Mo-Kyo, the Inner Mongolia, in the summer of 1942. Sapporo (Japan) Soc. Agr. & For. J. 36(3):91–97.

Cites the occurrence of *Septoria glycines* on soybean collected August 19. Only the most conspicuous parasitic fungi were reported in this article.

2057. TOKUNAGA, Y., and Y. HASHIOKA. 1948. A preliminary report on crop diseases of Hainan Island [in Chinese]. Taiwan Agr. Res. Inst., Agr. Bull. 2, pp. 131–134.

Soybean was attacked by *Phakopsora sojae* (= *P. pachyrhizi*), *Septoria glycines, Peronospora manshurica,* and *Corticium centrifugum.*

2058. TOLIN, S. A., R. H. FORD, and C. W. ROANE. 1974. Purification and serology of peanut mottle virus from soybean and peanut. Proc. Amer. Phytopath. Soc. 1:114. (Abstr.)

Peanut mottle virus (PMV) was isolated frequently from soybean (*Glycine max* (L.) Merrill) and from peanut (*Arachis hypogaea* L.) in areas in which both are cultivated. Several strains could be differentiated based on systemic symptoms in soybean (cultivars Kanrich, Lee), peanut (cultivar Virginia 56R) and pea (*Pisum sativum* L. cultivar Little Marvel), and on necrotic local lesion types in *Phaseolus vulgaris* L. cultivars Top Crop and Kentucky Wonder Wax. A strain from soybean designated severe (PMV-S) was purified from pea by extraction in O.1M tris-HCl, pH 8.0, containing 0.05M EDTA and 0.02M Na_2SO_3, followed by chloroform clarification and polyethylene glycol precipitation. Pellets were resuspended in 0.01M tris containing 0.5M urea and 0.001M EDTA. Single, homogeneous zones in sucrose rate-zonal centrifugation and yields of 10-25 mg per kg of tissue were obtained routinely. Antiserum to PMV-S reacted with all other PMV strains in SDS-immunodiffusion tests. PMV-S reacted with PMV antisera from Georgia and North Carolina in microprecipitin and immunodiffusion tests. Reciprocal tests with PMV and soybean mosaic virus were negative.

2059. TOLLENAAR, H., and C. MARTIN. 1972. Perchlorate in Chilean nitrate as the cause of leaf rugosity in soybean plants in Chile. Phytopathology 62:1164–1166.

Chilean $NaNO_3$ applications produced strongly crumpled leaves with burned tips and reduced terminal growth of soybean plants. Potassium perchlorate, a component of Chilean nitrate, was found to be responsible for this disorder. Residues of potassium perchlorate in the soil originating from Chilean nitrate applied in previous seasons caused leaf rugosity in nonfertilized commercial soybean plantings. However, a light degree of perchlorate injury in field-grown soybean plants affected neither yield nor chemical composition of the seed.

2060. TOLMACHEVA, E. A. 1966. [Viruses of legumes in the Central Botanical Garden of Byelorussian Academy of Sciences (Identification).] Vestsi Akad. Navuk. BSSR, Ser. Biyal. Navuk 1966 (4):125–129.

Bean yellow mosaic was found in soybeans.

2061. TOMERLIN, A. H., JR., and V. G. PERRY.

1967. Pathogenicity of *Belonolaimus longicaudatus* to three varieties of soybean. Nematologica 13:154.

Several legumes, including cowpea, peanut, and soybean, have been reported to be hosts for sting nematodes of the genus *Belonolaimus.* However, previous work at the University of Florida indicated difficulty in maintaining populations of a colony of *B. longicaudatus* on soybean cultivars Jackson and Hinson (3734). Three experiments were designed to determine parasitism or pathogenicity of a colony of *B. longicaudatus* collected at Gainesville, Fla., to soybean cultivars Lee, Hinson, and Bansei. The first experiment involved 16 wooden flats which were filled with field soil naturally infested by *B. longicaudatus.* Eight of these were fumigated with methyl bromide and planted; four were fumigated, reinoculated, and planted; four were planted without fumigation or inoculation. Each flat was planted with cultivar Lee. A second experiment consisted of three tests, one each with Lee, Hinson, and Bansei cultivars. Each test contained four treatments of 0, 10, 100, and 500 nematodes per 6-in. clay pot with five replications. Autoclaved soil and handpicked nematodes were used in each test. The third experiment involved direct observations of specimens of the parasite associated with roots from plants of cultivar Lee grown in root observation boxes and in 2% water agar in petri dishes. Data on plant growth as measured by height and dry weight, increase of nematode populations, and direct observations of feeding on roots indicate that *B. longicaudatus* is a parasite on Lee, Hinson, and Bansei cultivars of soybean and a pathogen of Lee and Hinson.

2062. TOMOYASU, R. 1924. The causal fungus of purple seed of soybean [in Japanese]. J. Plant Prot. (Tokyo) 11:310–315.

The purple-seed fungus was identified as *Cercosporina* sp. (= *Cercospora* sp.).

2063. TRIANTAPHYLLOU, A. C., and H. HIRSCHMANN. 1962. Oögenesis and mode of reproduction in the soybean-cyst nematode, *Heterodera glycines.* Nematologica 7:235–241.

Oögenesis and mode of reproduction were studied in four populations of the soybean-cyst nematode, *Heterodera glycines.* Oögeneal divisions occurred before and during the fourth molt. Maturation of oöcytes proceeded only in inseminated females and was normal, consisting of two meiotic divisions and the formation of two polar nuclei. Nine bivalents were present at metaphase I in all populations. Sperm entered the oöcytes at late prophase or early metaphase I. Following the second maturation division, sperm and egg pronuclei fused to form the zygote nucleus. Six females obtained from 200 larval inoculations of soybean seedlings failed to produce embryonated eggs and showed marked retardation in growth. In conclusion, *H. glycines* has a normal meiotic cycle and reproduces by cross-fertilization.

2064. TRIANTAPHYLLOU, A. C. 1970. Cytogenetic aspects of evolution of the family Heteroderidae. J. Nematol. 2:26–31.

A review article.

2065. TROPOVA, A. T. 1929. The active acidity of the cell sap of some plants and their susceptibility to fungus and bacterial infection [in Russian, English summary]. J. Agr. Res. North Caucasus 13:3–16.

The cell sap of the leaves of 18 cultivars of soybean were checked and the pH varied from 5.72 (a cultivar with a 58.3% infection by *Bacterium sojae* (= *Pseudomonas glycinea*) to 6.32 (a cultivar showing no infection). The author checked the pH relationships between fungi and bacteria on various economic crops and summarizes, in part: In the selection of cultivars, which are resistant to diseases, the determination of the pH value of the cell sap might be used as one factor on which a selection may be based.

2066. TRUSKOVA, G. M. 1971. Study of the plant nematodes of soybean in the Amur region [in Russian]. *In* [Biologicheskie i Meditsinskie Issledovaniya na Dal'nem Vostoke.] Vladivostok: Akademiya Nauk SSSR, Dal'nevostochnyi Nauchnyi Tsentr. 84–86.

Investigation of the nematode fauna associated with soybean in the Amur region of the U.S.S.R. in 1968 revealed 37 species, 12 of them phytohelminths according to Paramonov's classification. The most numerous species were *Panagrolaimus rigidus, Acrobeloides amurensis, Mesorhabditis signifera,* and *Aphelenchus avenae.*

2067. TRUSKOVA, G. M. 1972. Description of a new species of *Anaplectus* (Nematoda Plectidae), with a key to species of the genus [in Russian, English summary]. Zoologicheski Zhurnal 51(4):594–596.

Anaplectus intermedius n.sp. was found in the roots and rhizosphere of soybean in the Amur region (U.S.S.R.). It is intermediate in morphology between *A. submersus* and *A. granulosus.* It differs from *A. submersus* in shape of the gubernaculum and from *A. granulosus* in structure of the lip region and size of the first supplementary organ. The author considers the principal diagnostic characters of the genus to be structure of the spicules and gubernaculum, size of the first supplementary organ, and structure of the head end, and accordingly gives a key to the six species of the genus.

2068. TSAI, K., Y. LU, and H. I. OKA. 1974. Mutation breeding of soybean for the resistance to rust disease. Sabrao J. 6:181–191.

Since no proper parental strain resistant to the rust disease (caused by *Phakopsora pachyrhizi*) was available, the seeds of six soybean cultivars selected for wide adaptability in Taiwan were subjected to mutagenic treatments (gamma-ray and EMS). About 240,000 M_2 to

M_4 plants grown in bulk and about 5,000 M_3 to M_6 lines derived from seemingly resistant plants were tested under natural infection at a village where the disease prevailed, and selection was repeated. Some of the lines thus selected showed a moderately high resistance which appeared to be due to induced mutations. In view of continuous variation in susceptibility grade and no remarkable changes in agronomic characters and yield found in most selected lines, the induced resistance was considered to be due to genic changes with minor effects.

2069. TSUTSUMI, M., and K. SAKURAI. 1966. Influence of root diffusates of several host and nonhost plants on the hatching of the soybean-cyst nematode, *Heterodera glycines* Ichinohe, 1952 [in Japanese, English summary]. Japan. J. Appl. Ent. and Zool. 10:129–137.

Root diffusates of soybean, adzuki bean, kidney bean, and wheat were tested to determine their effect on egg hatching and larval emergence of the soybean-cyst nematode under laboratory conditions. In general, a significantly greater number of larvae were counted in root leachings and root secretions of host plants, whereas no stimulatory effect on egg hatching and larvae emergence was noticed by nonhost leachates and distilled water. The rate of hatching in kidney bean leachate was higher than from soybean and adzuki bean, particularly at earlier growth stage. Presence of substances in root exudates of host crop, stimulating hatching, is not yet conclusive.

2070. TU, C. 1932. Notes on diseases of economic plants in South China. Lingnan Sci. J. 11:489–504.

Includes *Uromyces sojae* (= *Phakopsora pachyrhizi*) on soybean.

2071. TU, C. C., and Y. H. CHENG. 1970. Studies on the sources of *Diplodia gossypina* Cook for primary infection on cottons. Plant Prot. Bull. Taiwan 12:147–151.

Soybean was susceptible on inoculation with *Diplodia gossypina.*

2072. TU, J. C., R. E. FORD, and S. S. QUINIONES. 1969. Effect of soybean mosaic virus infection on development of nodules on soybean. Phytopathology 59:1054. (Abstr.)

The effect of soybean mosaic virus (SMV) on root nodule development in soybean was studied with combinations of three SMV strains and four soybean cultivars in the greenhouse. Soybeans were planted in *Rhizobium*-infested soil, inoculated with SMV at weekly intervals beginning at the unifoliolate stage, and harvested 2.5 months later. Reduction in weight, number, and size of nodules occurred in all SMV-infected soybean cultivars. Nodule differences were small within soybean cultivars infected with different SMV strains. For example, early infection of Bansei soybean with SMV-O caused greater reduction of nodule weight than late infection. Maximum reductions occurred when inoculated 9 weeks or later after sowing. Fresh weight decrease of SMV-infected soybeans is assumed to be caused primarily by decreased photosynthesis and increased respiration. However, reduced nodulation may also be an important factor.

2073. TU, J. C., and R. E. FORD. 1969. Translocation of maize dwarf mosaic and soybean mosaic viruses from inoculated leaves. Phytopathology 59:1158–1163.

Translocations of soybean mosaic virus (SMV) from mechanically inoculated leaves was studied at temperatures from 10–26 C. Movement of SMV was temperature-dependent and correlated with establishment of infection and initial virus multiplication. Virus multiplication took place in inoculated leaves before translocation occurred, and increased with increasing incubation temperature from 10–26 C. Time for SMV movement from inoculated leaves was shortened with increasing temperature. Virus movement from inoculated leaves occurred faster at 26.5 C than at 21 and 15.5 C. SMV multiplication was almost nil at 10 C, whereas corn and soybean growth was retarded, and no movement of SMV could be detected 5 days after infection. Translocation of SMV to roots and leaves occurred almost simultaneously. However, SMV titers were lower in roots than in leaves. SMV concentrations appeared greater in the root tip area than in the older portion of the roots.

2074. TU, J. C., R. E. FORD, and S. S. QUINIONES. 1970. Effects of soybean mosaic virus and/or bean pod mottle virus infection on soybean nodulation. Phytopathology 60:518–523.

Nodulation was studied in soybeans infected with soybean mosaic virus (SMV), with bean pod mottle virus (BPMV), or with both viruses. Nodule differences were marked between soybean cultivars but were small within soybean cultivars infected with different SMV isolates. Number, size, and weight of nodules were reduced by SMV infection, and the earlier the infection, the greater the reduction. Maximum reduction (81%) occurred when Bansei soybeans were inoculated 2 weeks after sowing, but none occurred 9 weeks after or later. Marked decreases in nodule number often resulted in an increase in nodule size in virus-infected plants. A mixed infection of soybeans by SMV and BPMV reduced nodules more than single infections. Frequent fertilizer applications reduced nodule production in both healthy and SMV-infected plants. Decrease in plant fresh weight in SMV-infected soybeans has been attributed primarily to decreased photosynthesis and increased respiration. Reduced nodulation may also be an important factor.

2075. TU, J. C., and R. E. FORD. 1970. Free amino acids in soybeans infected with soybean mosaic virus, bean pod mottle virus, or both. Phytopathology 60:660–664.

Free amino acids were measured quantitatively in soy-

bean leaves infected with three soybean mosaic virus (SMV) isolates differing in virulence and with bean pod mottle virus (BPMV) alone or in combination with SMV. Total free amino acids and ammonia increased with virus infection. Individual amino acids decreased, however, or were variable depending on the SMV isolate. Free amino acid content appeared closely correlated with symptom severity. Free amino acid concentration increases were in order of SMV-O- was greater than SMV-NC- which was greater than SMV-M-infected soybean. BPMV and SMV-O had a synergistic effect on soybeans in some free amino acids, because free amino acid increased in mixed infections but did not increase in proportion with increased disease severity.

2076. TU, J. C., R. E. FORD, and C. R. GRAU. 1970. Some factors affecting the nodulation and nodule efficiency in soybeans infected by soybean mosaic virus. Phytopathology 60:1653–1656.

Total N in nodules of soybeans infected by soybean mosaic virus (SMV) was consistently higher, and nodule weight was consistently lower, than in comparable healthy plants at different temperatures, day lengths, and growth stages. Differences in nodule weight between SMV-infected and healthy soybeans were small at 15.5 C, but increased with increasing temperature (to 26.5 C). Similarly, differences in nodule weight between SMV-infected and healthy soybeans were small at a short (6 hr.) day length, but increased at longer day lengths (10 and 14 hr.). When inoculated with *Rhizobium japonicum* at different growth stages, healthy soybeans were always more susceptible to *Rhizobium* infection than were SMV-infected plants. Reduced susceptibility to *R. japonicum,* decreased leghemoglobin, and increased total N in SMV-infected soybean nodules suggests that nodules on SMV-infected plants were less efficient than nodules on healthy plants.

2077. TU, J. C. 1973. Electron microscopy of soybean root nodules infected with soybean mosaic virus. Phytopathology 63:1011–1017.

Thin sections of developing central tissue cells of soybean mosaic virus (SMV)-infected soybean root nodules were studied. The development of rhizobial infection threads and the processes of releasing rhizobia into nodule tissue cells appeared to be little affected by SMV infection. The infection threads of rhizobia were usually present in the young central tissue cells near the meristem of the nodule, and in these cells small SMV aggregates, pinwheels, and bundle inclusions were also found. Cells free of rhizobial infection threads were generally infected with SMV. SMV infectivity in root nodules was consistently higher than that in the root tissues. The presence of virus aggregates in the root nodule cells is further evidence that SMV could multiply in the root nodule cells despite the presence of *Rhizobium.*

2078. TUCKER, C. M. 1924. Report of the plant pathologist. Puerto Rico Agr. Expt. Sta. Rpt. 1923, pp. 15–16.

Soybeans were attacked by a disease causing a shrivelling of the seed in the pods.

2079. TUITE, J. 1960. The natural occurrence of tobacco ringspot virus. Phytopathology 50:296–298.

Tobacco ring spot virus (TRSV) was tested in 454 plants of 37 species from an area adjoining a field of soybean where bud blight was epidemic. *Ambrosia artemisifolia, Daucus carota, Erigeron strigosus, Rumex acetosella, Taraxacum officinale* and *Trifolium repens* were symptomless carriers of the virus. *Melilotus* spp. and *Trifolium pratense* showed symptoms. Attempts at mechanical infection of 5 of the 8 above-mentioned natural hosts were largely negative. Of seed from infected dandelion, 9–36% produced plants infected with TRSV (symptomless) ; no seed transmission was found in *E. strigosus.*

2080. TURNER, G. J. 1964. New records of plant diseases in Sarawak for the year 1962. Gardens' Bull. (Singapore) 20:369–376.

A report of one record of leaf rot (*Corticium solani*) on soybean and *Glycine javanica* and one record of wilt and pod rot (*Sclerotium rolfsii*) on soybean.

2081. TYLER, L. J. 1943. Soybean downy mildew in Pennsylvania. Plant Dis. Reptr. 27:603.

Records the occurrence of *Peronospora manshurica.*

2082. UEHARA, K. 1958. On the phytoalexin production of the soybean pod in reaction to *Fusarium* sp., the causal fungus of pod blight. I. Some experiments on the phytoalexin production as affected by host plant conditions and on the nature of phytoalexin produced [in Japanese, English summary]. Ann. Phytopath. Soc. Japan 23:225–229.

Drops of spore suspension of *Fusarium* were mounted on the inner surface of the seed cavities of pods at different ages; after centrifuging, the supernatant was tested for inhibitory action on the germination of fresh spores of *Fusarium.* It was found that the phytoalexin diffused distinctly into the drops placed on young, unmatured pods, but hardly or not at all into the drops on mature pods. Phytoalexin productivity of the host tissue was determined by changing daily the drops placed on given points of young pods with new spore suspension, and by measuring the inhibitory action of the diffusates each day. Production of phytoalexin decreased remarkably on the second day and sank nearly to zero on the fourth day. Phytoalexin in the diffusate from the pods lost most of its inhibitory activity when heated to 100 C for 5 min. or diluted 1:8.

2083. UEHARA, K. 1959. On the phytoalexin production of the soybean pod in reaction to *Fusarium* sp., the

causal fungus of pod blight. II. On the effect of conditions of the spore suspension of the causal fungus upon phytoalexin production [in Japanese, English summary]. Ann. Phytopath. Soc. Japan 24:224–228.

Phytoalexin was produced abundantly when suspensions containing *Fusarium* spores of more than 40 per microscope field (× 150) were placed on the soybean pod; phytoalexin was not produced when suspensions contained 3–6 spores per field or a spore suspension was heated at 100 C for 10 min. or a supernatant of macerated spores was used. The supernatant of a spore suspension incubated for 24 hr. at 23 C was able to induce phytoalexin production but lost the ability when heated for 10 min. at 60 C.

2084. UPPAL, B. N., M. K. PATEL, and M. N. KAMAT. 1935. The fungi of Bombay. Bombay Dept. Agr. Bull. 176. 56 pp.

States that *Corticium solani* has been reported on soybean in Mirpurkhas.

2085. UPPAL, B. N., M. K. PATEL, and M. N. KAMAT. 1938. Bacterial leaf-spot of soybean in Bombay. J. Univ. Bombay 6:16–18.

An organism isolated from a leaf spot of soybean at Jalgon in 1934 is identified as *Phytomonas* (= *Xanthomonas*) *phaseoli* var. *sojense*.

2086. URS, N. V. R. R., and J. M. DUNLEAVY. 1970. Growth and synnemata development of *Cephalosporium gregatum* at various pH levels. Iowa State J. Sci. 45: 211–215.

Isolates of *Cephalosporium gregatum* from Mexico, Illinois, and Iowa all grew at pH 6–10. The Mexican isolate grew best at all levels. With NH_4OH however, there was no growth of the Iowa isolate at pH 9 or of the Iowa and Illinois isolates at pH 10. Only the Mexican isolate developed synnemata at pH 7–10 irrespective of bases and buffers. Growth of all isolates was obtained when pH was adjusted to 10 with KOH, instead of NH_4OH.

2087. URS, N. V. R. R., and J. M. DUNLEAVY. 1974. Bactericidal activity of horseradish peroxidase on *Xanthomonas phaseoli* var. *sojense*. Phytopathology 64:542–545.

Horseradish peroxidase (HRP) was bactericidal on *Xanthomonas phaseoli* var. *sojense*, a bacterium pathogenic on soybeans, in the presence of potassium iodide (KI) and hydrogen peroxide (H_2O_2). The antibacterial activity was greatest when HRP was used at 50 μg/ml; concentrations greater than 50 μg/ml did not increase the bactericidal activity. The antibacterial activity of HRP was largely prevented by preheating the enzyme at 80 C for 20 min. or by deleting H_2O_2 from the assay system. Addition of ascorbic acid (20 nmoles/ml) to the assay system increased the bactericidal activity of HRP. Substituting dehydro-ascorbic acid for ascorbic acid further enhanced the bactericidal activity of HRP, resulting in total loss in viability of the bacterium.

2088. U.S. DEPARTMENT OF AGRICULTURE. 1956. Soybean-cyst nematode. U.S. Dept. Agr., Agr. Res. Serv., ARS 22-29. 10 pp.

This is a general report on the soybean-cyst nematode. A description of the nematode, its distribution, hosts, research, quarantine, and the importance of host plants all are presented.

2089. U.S. DEPARTMENT OF AGRICULTURE. 1960. Soybeans are being bred to resist soybean-cyst nematode. U.S. Dept. Agr., Agr. Res. 9(1):12.

Resistant cultivars of soybeans are being bred for planting in cyst nematode infested soil. Three recessive genes control resistance. Breeding work is under way in Mississippi, Missouri, North Carolina, and Tennessee.

2090. U.S. DEPARTMENT OF AGRICULTURE. 1961. Soybean-cyst nematode. Progress in research and control. U.S. Dept. Agr., Agr. Res. Serv., ARS 22–72. 20 pp.

This general report covers the soybean-cyst nematode, its occurrence, life cycle, type of damage, hosts, spread, and control. Sections on rotations, soil treatments, resistance, and survey methods are included.

2091. U.S. DEPARTMENT OF AGRICULTURE. 1961. Rotations help control soybean-cyst nematode. U.S. Dept. Agr., Agr. Res. 10(6):11.

Rotation studies in Tennessee show that good control of the soybean-cyst nematode can be obtained by growing nonhost crops in rotation with soybeans in heavily infested fields. Yields were clearly associated with the number of larvae in the soil at beginning of the growing season.

2092. U.S. DEPARTMENT OF AGRICULTURE. 1966. The soybean-cyst nematode. U.S. Dept. Agr. Program Aid 333 (rev. 1968). 4 pp.

This is a general publication on the soybean-cyst nematode, describing forms of damage, how it lives, how it is spread, detection in field, and control measures.

2093. VACLAV, V., L. RADMAN, J. BATINICA, M. RISTANOVIC, N. DIMIC, R. NUMIC, and A. BES. 1970. [Contributions to the knowledge of diseases and pests of soybean in the productive regions of Bosnia.] Zashtita Bilja 21:229–236.

Macrophomina phaseoli (= *M. phaseolina*), *Peronospora manshurica, Phyllosticta sojaecola, Pseudomonas glycinea,* soja virus 1 (soybean mosaic virus), and soja virus 2 (bean yellow mosaic virus) were detected on soybean during 1965–1967. *P. manshurica* caused the most damage in Bosnia region of Yugoslavia.

2094. VALLEAU, W. D. 1932. Seed transmission and virility of two strains of tobacco ringspot. Kentucky Agr. Expt. Sta. Bull. 327.

2095. VANCHIKOV, K. T. 1941. New parasitic fungi for Bulgaria. First contribution [in Bulgarian, German summary]. Spis. Zeml. Opitni. Inst. v. Bulgariia 11(4): 33–43.

First report for Bulgaria of *Phyllosticta sojaecola* collected in August 1941. Taxonomic notes and other details are given.

2096. VAN DER GOTT, P., and H. R. A. MULLER. 1932. Pests and diseases of the soybean crop in Java. Preliminary report [in Dutch, English summary]. Landbouw Tijdschr. Landb. Nederl.-Indie 7:683–704.

Diseases on soybeans in Java are mostly of minor importance. The following diseases have been found: some diseases caused by *Bacterium solanacearum,* foot rot caused by *Sclerotium rolfsii,* and anthracnose caused by *Colletotrichum glycines.* Under wet conditions foot-rot may cause some losses.

2097. VAN DER LINDE, W. J. 1956. The Meloidogyne problem in South Africa. Nematologica 1:177–183.

Glycine javanica is reported as a host of *Meloidogyne incognita acrita* and *M. javanica.* Discusses the need of creating a different species of *Meloidogyne,* and variations in regard to some host reactions within *M. incognita acrita* group.

2098. VAN DER WOLK, P. C. 1916. Study of a bacterial disease of soybean and the nature of the root nodules of *Glycine soja* and *Arachis hypogaea.* Cultura 28: 268–285, 300–319.

The disease first appears as an etiolated condition and may result in death of the plant. It was considered to be caused by activities of the bacterium *Rhizobium beijerinckii,* associated with root nodules.

2099. VAN HALL, C. J. J. 1921. [Diseases and pests of cultivated plants in the Dutch East Indies during 1921.] Medea. Inst. voor Plantenziekten 53:1–46.

Bacterium (= *Pseudomonas*) *solanacearum* was isolated from soybeans.

2100. VAN NIEKERK, B. P., and M. LOMBARD. 1967. Soybean mosaic and mottled seed. Farming S. Africa 43:7–9.

Symptoms of mosaic, occurring particularly in late-maturing soybean cultivars, and seed coat mottling, both known in South Africa since 1961 and not previously associated, have recently been attributed to infection by soybean mosaic virus. The disappearance of mosaic symptoms as the season progresses and the temperature rises should not be regarded as evidence of complete recovery. Steps to combat the disease by elimination of affected plants early in the season, growing of seed from noninfected areas, and rotation with resistant grain crops are recommended.

2101. VAN WEERDT, L. G., W. BIRCHFIELD, and R. P. ESSER. 1959. Observations on some subtropical plant-parasitic nematodes in Florida. Proc. Soil and Crop Sci. Soc. Florida 19:443–451.

Soybean was established as a host of *Radopholus.* This is believed to be the first record of this nematode on soybean.

2102. VARDANIYA, L. Y. 1970. Verticillium of soybean [in Russian]. Zashch Rast. Mosk. 15:51–52.

In Russia, *Verticillium dahliae,* causing death of 30–90% of plants of some cultivars, was detected at all stages especially at the end of growing period. Previously the disease was confused with *Fusarium* infection. Conidia formed on all infected parts, particularly in wet weather. Control measures should include crop rotation, seed treatment with thiram or granosan, and soil disinfection with 3% carbathion 1 month prior to planting.

2103. VARDANIYA, L. Y. 1971. [Diseases of soybean in Abkhazia.] Zashch Rast. Mosk. 16:40–41.

The pathogens detected during 1966–1969 (in this area on the eastern Black Sea coast of U.S.S.R.) include *Fusarium solani* causing root rot, *F. solani* and *F. avenaceum* causing seed and seedling rot, *F. oxysporum* causing wilt of mature plants, *Verticillium dahliae* and *Sclerotium rolfsii.* Of 210 cultivars tested only 16 were relatively resistant to *V. dahliae* and only 12 to *C. rolfsii.*

2104. VARELA, G. R., and S. H. ORUZCO. 1969. Effectivity of some fungicides in the control of downy mildew of soybean (*Glycine max* (L.) Merr.) caused by *Peronospora manshurica* (Naum) syd. [in Spanish, English summary]. Acta Agron. Palmira 19:7–15.

The best field control of *Peronospora manshurica* in Cauca Valleu, Colombia, was given by bordeaux and copper oxychloride out of eight fungicides applied 30, 45, and 60 days after germination of cultivar Hale 3. The pathogen seems not to affect yield when infection takes place after flowering in susceptible cultivars, i.e., about 60 days after germination.

2105. VASILEVA, L. M., and P. P. BULAKH. 1971. Source material for breeding soybean for resistance to fungus diseases [in Russian, English summary]. Trudy prikl Bot. Genet. Selek. 45:236–239.

Tests at the Russian Far East Experiment Station VIR since 1961 showed Mauthner Sedy Mnich, Tokachi-Nagacha, Japan II, Ishikari-Shiro I, Brun gesto ronest, and Pavlikene 2 to be highly resistant to *Cercospora daizu* and *Peronospora manshurica,* and resistant to *Septoria glycines, Ascochyta sojaecola,* and *Phyllosticta sojaecola.* Broun de Manninoux and Fousou 2 were highly

resistant to *P. manshurica* and *A. sojaecola* and resistant to *S. glycines, C. daizu,* and *P. sojaecola.*

2106. VASSILIEFF, A. A. 1933. Wilt of cultivated best-yielding plants under Central Asian conditions [in Russian]. *In* Diseases and pests of new cultivated textile plants, pp. 22–24. Inst. New Bast Material Vaskhnil, Moscow.

Soybean became infected by *Verticillium dahliae* when sown in pots that previously bore severely infected cotton plants. The external symptoms on soybean are similar to those on cotton.

2107. VASUDEVA, R. S. 1958. Report of the division of mycology and plant pathology. Sci. Rpt. Agri. Res. Inst. New Delhi, 1955–56, pp. 55–104.

A yellow mosaic virus of *Phaseolus aureus* was transmitted by *Bemisia tabaci* but not by sap inoculation to soybean.

2108. VASUDEVA, R. S. 1963. Indian Cercosporae. New Delhi. 245 pp.

A taxonomic description with figures of *Cercospora sojina* Hara on *Glycine javanica* L. This species is distinct from *C. cruenta* Sacc., *C. flagellifera* Atkinson, *C. kikuchii* Matsumoto and Tomoyashi, and *C. glycines* Cooke on *Glycine* spp. in having hyaline, cylindric, and wide conidia.

2109. VASUDEVA, R. S. 1963. Division of mycology and plant pathology, Indian Agr. Res. Inst. (New Delhi). Sci. Rpt. 1961, pp. 87–100.

First report of *Corynespora cassiicola* on soybean for India.

2110. VEECH, J. A., and B. Y. ENDO. 1968. Enzyme localization in Lee soybeans infected with the root-knot nematode *Meloidogyne incognita acrita.* Phytopathology 58:1070. (Abstr.)

An abstract of entry 2111.

2111. VEECH, J. A., and B. Y. ENDO. 1969. The histochemical localization of several enzymes of soybeans infected with the root-knot nematode *Meloidogyne incognita acrita.* J. Nematol. 1:265–276.

The sites of activity of alkaline phosphatase, acid phosphatase, esterase, peroxidase, adenosine triphosphatase, and cytochrome oxidase were demonstrated histochemically in fresh sections of Lee soybeans infected by the root-knot nematode *Meloidogyne incognita acrita.* Each of the six enzymes was more active at the sites of infection than in adjacent noninfected tissue. During the early stages of infection, an increase in enzyme activity was observed in several cells in the proximity of the lip region of the nematode. However, when definite syncytia were observed, increased enzyme activity was confined primarily within the limits of the syncytium. Increased activity paralleled syncytial development and nematode maturation.

2112. VEECH, J. A., and B. Y. ENDO. 1969. Alterations in enzyme localization in soybeans infected with *Meloidogyne incognita acrita.* J. Nematol. 1:307–308. (Abstr.)

The sites of activity of alkaline phosphatase, acid phosphatase, nonspecific esterase, peroxidase, adenosine triphosphatase, and cytochrome oxidase were demonstrated histochemically in fresh sections of Lee soybeans infected with *Meloidogyne incognita acrita,* a species of root-knot nematode. Each of the enzymes was found to be more active at the feeding site of the nematode than in adjacent cells of the same tissue. During the early stages of infection, increased enzyme activity was localized in several cells in the proximity of the lip region of the nematode. However, when definite syncytia were observed, the increased enzyme activity was confined primarily within the boundaries of the syncytia. An increase in enzyme activity preceded the induction of syncytia. However, after syncytia were formed, further increases in activity paralleled syncytial development and nematode maturation. Based upon previous studies and the enzymes demonstrated here, it appears that a general increase in host metabolism is associated with the induction and development of syncytia. Further, this increased metabolic response is more peculiar to susceptible than resistant host plants.

2113. VEECH, J. A., and B. Y. ENDO. 1970. Comparative morphology and enzyme histochemistry in root-knot resistant and susceptible soybeans. Phytopathology 60:896–902.

A comparison was made of certain enzyme histochemical and morphological responses of susceptible Lee and resistant Delmar soybeans to infection by *Meloidogyne incognita acrita.* The activity of certain oxidoreductive, hydrolytic, and oxidative enzymes of the susceptible cultivar were increased significantly, primarily within the syncytium. Initially, galling response to infection was similar in both susceptible and resistant plants, i.e., slight galling was observed prior to microscopic detection of syncytia. During the first few days after inoculation, both cultivars showed a similar, slight increase of host enzyme activity at the nematode feeding site. With further disease development, however, responses of the two cultivars differed. In the susceptible host, syncytia developed at the site of nematode feeding. These syncytia generally developed into extensive units that contained increased levels of enzyme activity. The syncytia usually were sufficient to support development of the nematode to maturity. At a time corresponding to syncytia induction in the susceptible host, the most common resistant host response was cell necrosis. Often after inducing necrosis, the nematode migrated to nonnecrotic cells and commenced feeding; these cells subsequently became necrotic. An

increase in enzyme activity was seldom found in resistant-host cells associated with nematode feeding. Unlike the susceptible plant response to the nematode, the resistant plant rarely produced syncytia. In rare cases, however, where the nematode induced syncytia in the resistant plant, the syncytia contained increased levels of enzyme activity.

2114. VERMA, G. S., J. P. VARMA, and P. N. SAXENA. 1962. Top necrosis of *Cyamopsis tetragonoloba* (L.) Taub. Proc. India Natl. Acad. Sci., Sect. B. 32: 287–292.

Soybean is susceptible to the virus upon inoculation. It may be a strain of tobacco ring spot virus.

2115. VERMA, H. S., and P. N. THAPLIYAL. 1974. Soybean (*Glycine max*), Rhizoctonia aerial blight, *Rhizoctonia solani*. Amer. Phytopath. Soc. Fungicide and Nematicide Tests, Results of 1973. 29:95.

A field trial using soybean cultivar Bragg was conducted in the kharif season of 1972–1973 to determine a suitable control measure for Rhizoctonia aerial blight of soybeans. The fungicidal treatments used were: all possible combinations of soil treatment with brassicol (75 W @ 25 kg/ha), seed treatment with benomyl (50 W @ 0.2%) or cercobin-M (70 W @ 0.2%), and foliar sprays with benomyl (50 W @ 0.05%) or dithane M-45 (80 W @ 0.15%). There was no significant difference in number and dry weight of nodules in any of the treatment plots. When the crop was 11 weeks old, 80–90% leaves were showing infection in all treatments except in brassicol-benomyl-benomyl (soil-seed-spray) combination in which only 70% leaves were infected. All treatment combinations were effective in reducing the disease severity. Most effective treatment in terms of lowest disease severity and highest yield was brassicol-benomyl-benomyl (soil-seed-spray) combination. All treatment combinations except dithane M-45 (spray) alone, cercobin-M (seed) alone, or cercobin-M and dithane M-45 (seed-spray) combination gave significantly higher yields over check. No significant differences in the 100-grain weight were observed.

2116. VERMA, M. L. 1970. Reaction of soybean varieties to bacterial leaf spot disease caused by *Xanthomonas phaseoli* var. *sojense*. Mysore J. Agri. Sci. 4:366–367.

Of 15 cultivars tested in a field trial against natural infection, Hardee and Semmes were immune, and Dare, Davis, Lee, and Clark 63 were resistant.

2117. VERNETTI, F. D. J., and L. P. FERREIRA. 1970. [A new soybean disease in Rio Grande du Sol.] Pesquisa Agropec. Bras. 5:219–226.

Peronospora manshurica appeared in an epiphytotic form in 1968–1969. Suggested control measures include breeding for resistance, seed treatment with fungicides, seed inspection, quarantine, deep ploughing, and covering of crop residues.

2118. VEST, G., J. L. PETERSON, and J. R. JUSTIN. 1969. Phytophthora rot of soybeans in New Jersey. Plant Dis. Reptr. 53:556–557.

Although this is the first report of *Phytophthora* rot of soybeans in New Jersey, its presence has been known since 1963.

2119. VESTAL, E. F. 1944. Diseases in stored grain and soybeans in Iowa. Plant Dis. Reptr. 28:184–186.

Germination of soybean seed samples varied from 86.8 to 90%. Fungi present on the seed had not yet been determined.

2120. VIDANO, C., and M. CONTI. 1965. [Aphid transmission of cowpea mosaic virus isolated from cowpea in Italy.] Atti Accad. vci. Torino 99:1041–1050.

The virus is widespread in North Italy and was transmitted by aphids to soybean.

2121. VIR, D., S. GANGOPADHYAY, and A. GUAR. 1972. Evaluation of some systemic fungicides and antibiotics against *Macrophomina phaseoli*. Pesticides 6-(11):25–26.

Of four fungicides and one antibiotic tested in the field against *Macrophomina phaseoli* on soybean, topsin and BAS31991F at 1,000 ppm gave the best results.

2122. VOELCKER, O. J. 1953. Annual report of the department of agriculture, Malaya, for the year 1952. 65 pp.

Corticium solani caused leaf rot of soybean. A new record for Malaya.

2123. VON ARX, J. A. 1957. [Die arten der galtun *Colletotrichum*.] Phytopath. Z. 29:413–468.

Colletotrichum truncatum is reduced to the form species level of *C. dematium* and renamed *C. dematium* f. *truncata*.

2124. VON WAHL, C. 1921. [Schädlinge an der sojabohne.] Zeitschr. Pflanzenkr. 31:194–196.

2125. VORONKERVICH, I. V., and T. N. SHMANENKOVA. 1968. Biological role of extracellular polysaccharides of *Xanthomonas phaseoli* var. *sojense* (Hedges) Burkholder, the causal agent of soybean bacteriosis [in Russian]. Biol. Nauki 11:95–100.

Glucose, mannose, xylose, and certain amino acids were detected by paper chromatography in the polysaccharide hydrolysate and the presence of uronic acids demonstrated by qualitative reaction. The abundance of polysaccharides prolonged the life of the pathogen under dry conditions and sunlight. Some UV radiation was absorbed by the polysaccharides. On inoculation they pro-

duced symptoms similar to those caused by the bacterium on solid media. The ability to produce these exudates is regarded as an adaptive mechanism of the bacterium.

2126. VOROS, J., and B. MOLNAR. 1958. *Peronospora manshurica* (Naumoff) Sydow, a new disease of soybeans in Hungary [in Russian, English summary]. Novenytermeles 7:371–374.

A description of symptoms, a literature review, and taxonomy, biology, and spread of the pathogen are given. Early cultivars seem to be more susceptible than late ones. Cultivars Bitter Kopf and Nagymagvu Feher were attacked severely and Korona and GM/1 moderately, whereas Szurke Barat and Gigant were resistant.

2127. VUI-YUI, D. 1961. The mosaic disease of the soybean varieties in Bulgaria [in Russian, English summary]. Rast. Zasht. (Bulgaria) 9:20–26.

Various symptoms on all the cultivars of soybean were caused by soja virus 1 (= soybean mosaic virus). The different cultivars reacted to the virus in a different manner, with temperature playing a certain role.

2128. VZOROV, V. I. 1938. Species and distribution of bacteriosis of agricultural plants in the Soviet Union [in Russian]. Akad. Sel'skokh. Nauk im V. E. Lenina Inst. Zashch Rast., Izvest. Rostov. Stants. Zashch Rast. 9:87–91.

Bacteria reported on soybeans are: *Bacterium lathyri* in the Azov-Black Seas area; and *B. phaseoli* var. *sojense* in Karachai, Leningrad Oblast and the Azovo-Black Seas area. *B. heteroceum* and *B. medicaginis* var. *phaseolicola* on soybean are grouped together with other hosts and reported as to localities from which the bacteria are known to occur.

2129. WAHL, V. 1921. [Schädlinge an der sojabohne.] Zeitschr. Pflanzenkr. 31:194–196.

Erysiphe polygoni and *Sclerotinia libertiana* (= *Whetzelinia sclerotiorum*) were observed on soybean in Augustenburg, Germany.

2130. WALKER, E. A. 1944. Fungi obtained from stubble of soybeans and other legumes in the New Jersey-Delaware-Maryland area. Plant Dis. Reptr. 28:686–687.

As observed on soybean: Rows of pycnidia occurred on the stem, fading out to a lighter-colored zone with fewer fruiting bodies. *Phomopsis sojae* was isolated from the zone of abundant pycnidia, while stylospores of *Phomopsis* were abundant in the zone of smaller and less frequent pycnidia. This was confirmed on many other samples. Soybean stubble appeared covered with leopard spots from which *Macrophomina phaseoli* was isolated. Both *Macrophomina* and *Phomopsis* were often found present on the same stems.

2131. WALKER, E. A. 1944. Soybean diseases in Maryland, Delaware, and New Jersey. Plant Dis. Reptr. 28:888–890.

Records the occurrence of *Pseudomonas glycinea, Cercospora sojina, Peronospora manshurica,* Phyllosticta leaf spot, *Septoria glycines,* and Alternaria leaf spot.

2132. WALKER, E. A. 1944. Diseases observed on soybeans in New Jersey, Delaware, and Maryland. Plant Dis. Reptr. 28:1006–1008.

Records the prevalence and occurrence of *Pseudomonas glycinea, Xanthomonas phaseoli* var. *sojense, Cercospora cruenta* (leaf spot), *C. canescens* (leaf spot), *C. sojina, Septoria glycines, Phyllosticta sojaecola, Diaporthe sojae* (= *D. phaseolorum* var. *sojae*), and *Peronospora manshurica.*

2133. WALKER, E. A. 1946. Soybean leaf spots in Maryland. Plant Dis. Reptr. 30:333.

Records the occurrence of *Cercospora cruenta* (?) leaf spot and *Phyllosticta sojaecola* leaf spot on soybean.

2134. WALLA, W. J. 1974. Effectiveness of foliar fungicides against *Diaporthe phaseolorum* var. *sojae* and for control of Phomopsis seed decay on soybeans. Proc. Amer. Phytopath. Soc. 1:167. (Abstr.)

Soybeans grown in the Gulf Coast area are often unsuitable for seed due to infection by *Diaporthe phaseolorum* var. *sojae* on and in seed which causes Phomopsis seed decay and seedling blight. Effectiveness of benomyl, triphenyltin hydroxide, Zn ion and Mn ethylene bisdithiocarbamate (1 lb. ai/acre), and leptophos (0.38 lb. ai/acre) against *D. phaseolorum* var. *sojae* was determined in vivo on Bragg soybean. Fungicides were applied at two locations on a randomized block design. Two applications were made, the first at early pod set and the second 21 days later. After harvest a random sample of the seed from each treatment was germinated on 1% water agar, and colonies of *D. phaseolorum* var. *sojae* were counted, and germination was determined. Fungicides prevented pod deterioration and invasion of *Diaporthe* sp. under field conditions. Yields were increased significantly with benomyl (29%), Zn ion and Mn ethylene bisdithiocarbamate (19%), and triphenyltin hydroxide (17%). Leptophos increased yields 8%. Germination showed a definite correlation to number of colonies of *Diaporthe* sp. As the number of colonies increased on the seed, germination decreased. Benomyl was the most effective material, with germination of treated beans 22% higher than nontreated beans.

2135. WALLACE, G. B. 1939. Plant diseases spread by bugs. East African Agr. J. 4:268–271.

As of 1937, *Nematospora coryli* and *N. gossypii* have been reported on soybeans in the Belgian Congo and South Africa. Spread by insects genera *Antestia, Callidea, Dysdercus, Leptoglossus, Nezara, Odontopus,* and *Phthia* of suborder Hepteroptera.

2136. WALLACE, G. B., and M. M. WALLACE. 1945. Tanganyika Territory fungus list: Recent records, VI. Dept. Agr. Tanganyika Mycol. Circ. 15, pp. 1–2.

Disease of soybean caused by *Rhizoctonia bataticola* (= *Macrophomina phaseolina*) is a new record.

2137. WALLACE, G. B., and M. M. WALLACE. 1947. Second supplement to the revised list of plant diseases in Tanganyika Territory. East African Agr. J. 13:61–64.

Lists *Ascochyta phaseolorum* on soybean occurring in Tanganyika.

2138. WALLACE, G. B., and M. M. WALLACE. 1949. A list of plant diseases of economic importance in Tanganyika Territory. Commonw. Mycol. Inst., Mycol. Papers 26:1–26.

Lists *Ascochyta phaseolorum, Cercospora* sp., *Macrophomina phaseoli* (= *M. phaseolina*) and a bacterial leaf spot on soybean.

2139. WALLEN, V. R., and T. F. CUDDY. 1960. Relation of seed-borne *Diaporthe phaseolorum* to the germination of soybeans. Proc. Assoc. Off. Seed Anal., 50:137–140.

There is an inverse correlation between germination of soybean seeds and their infection with *D. phaseolorum* var. *sojae*. Seed treatment of infected seeds with arasan, spergon, orthocide, phygon, or thioneb increased emergence and reduced the number of diseased seedlings, but did not control the disease completely.

2140. WALLEN, V. R. 1960. A high incidence of *Diaporthe phaseolorum* occurring in the seed of soybeans from southwestern Ontario. Plant Dis. Reptr. 44:596.

Soybean seeds of many cultivars were found infected with *Diaporthe phaseolorum* var. *sojae*. Of the 150 samples tested, 1–87% seeds of 90% of the samples were infected. Average seed emergence of the samples was 77.36%, 10–56% of which showed above-ground symptoms of the disease.

2141. WALLEN, V. R., and W. L. SEAMAN. 1962. *Diaporthe phaseolorum* in soybean seed. Proc. Canad. Phytopath. Soc. 29:11–20. (18) (Abstr.)

Seed treatment improved germination only when levels of infection were greater than 42%. Storage for 2 years at 10 C restored the germination of heavily infected seed to a satisfactory level.

2142. WALLEN, V. R., and W. L. SEAMAN. 1963. Seed infection of soybean by *Diaporthe phaseolorum* and its influence on host development. Canad. J. Bot. 41: 13–21.

Diaporthe phaseolorum, the causal agent of pod and stem blight of soybeans and generally regarded as a facultative parasite, has been found to be pathogenic during the seedling phase. The fungus caused severe losses of germinating seeds and young seedlings. In 1959 more than 30% of the soybean seed crop in southwestern Ontario was infected, and germination was severely reduced. *D. phaseolorum* was present in seed samples from this area in 11 of 13 years. Studies with a series of seed samples of varying levels of infection revealed that the fungus was still viable and pathogenic in the seed after storage for 2 years. However, during that time the levels of infection in most samples had decreased markedly, whereas a concurrent increase in germinability indicated that infected seeds were killed during the germination phase. While several seed treatment fungicides were effective in increasing germination and emergence in heavily infected samples, none completely controlled the disease. At normal planting rates, yield was not affected by levels of seed infection up to 42% but the yield was significantly lower in a sample containing 73% infected seed. It is concluded that the disease may be important in the seed and seedling phases of host development.

2143. WALTERS, H. J. 1958. A virus disease complex in soybeans in Arkansas. Phytopathology 48:346. (Abstr.)

In 1955 and 1956, a virus disease condition was observed in soybeans in the Arkansas River Valley. Losses in most fields were minor but a total loss occurred in a few fields. A variation of symptoms was observed in the field. Most plants showed a green mottling, with few or no pods and without marked stunting. Other symptoms included proliferation of floral buds, swollen nodes, dropping of immature pods, and failure of plants to mature. By the use of differential hosts and by a study of physical properties, four viruses were found occurring naturally in soybean. Soybean mosaic virus, pod mottle virus, and yellow stipple virus were isolated and identified. The fourth virus, still nonidentified, was obtained from the complex.

2144. WALTERS, H. J. 1961. Phytophthora rot of soybeans. Arkansas Farm Res. 10(2):2.

A popular article describing symptoms and losses due to *Phytophthora sojae* (= *P. megasperma* var. *sojae*). Cultivars Lee and Hill are described as moderately resistant.

2145. WALTERS, H. J. 1961. A premature dying of soybeans in Arkansas. Phytopathology 51:646. (Abstr.)

Premature killing of plants of early-maturing soybean cultivars in sandy-type soils has been observed for several years. During late summer, following the stress of short droughts, tops of plants were killed and reddish nodal cankers appeared along with internal reddening of stems. Fungi most frequently isolated from affected plants were *Fusarium* spp., *Diaporthe phaseolorum* var. *sojae, Glomerella glycines, Sclerotium rolfsii,* and *Macrophomina phaseoli.* Other organisms isolated were *Alternaria* sp., *Cladosporium* sp., *Cercospora* spp., *Curvularia* sp., *Penicillium* spp., *Aspergillus* spp., *Acrostalagmus* sp.,

Colletotrichum sp., *Epicoccum* sp., *Helminthosporium* spp., and several nonidentified fungi and bacteria. Symptoms resembling those observed in nature were produced only by inoculation with *M. phaseoli*. Pod mottle and tobacco ring spot viruses were isolated from affected plants; the latter virus produced symptoms similar to premature killing. Fumigation with methyl bromide significantly increased yields and reduced prevalence of *M. phaseoli*. Premature killing seems caused by an interaction of several factors; *M. phaseoli* and possibly tobacco ring spot virus may be important contributing factors.

2146. WALTERS, H. J. 1962. Variations in isolates of tobacco ringspot virus from soybeans. Phytopathology 52:31–32. (Abstr.)

The infrequent occurrence of bud blight, the symptom often expressed by tobacco ring spot virus (TRSV)-infected soybean plants, and the variation in symptoms associated with TRSV-infected soybeans suggest that several strains may infect soybean. Six of 18 isolates of TRSV, collected from naturally infected soybean plants, were studied and compared with four known strains of the virus. The isolates were identified as TRSV by the cross-protection test. Inoculum for most tests was prepared from cucumbers previously inoculated with virus from infected soybean plants. Differentiation of the isolates was based on the expression of symptoms produced on the following hosts: *Glycine max* cv. Dortchsoy 67, *Cucumis sativus, Lupinus albus, Phaseolus lathyroides, P. atropurpureus, P. vulgaris* cv. Idaho Refugee, *Canavalia ensiformis, Nicotiana tabacum* cv. Havana 38, *N. rustica, N. glutinosa, Dolichos lablab,* and *Stizolobium deeringianum* cv. Early Speckled. Two or more plants of each species were inoculated in each of five trials. The symptoms produced on certain hosts distinguished the six isolates from one another and from the four known strains. The isolates could be mixtures of known strains, but their consistent reaction in certain hosts indicates that they are definite strains.

2147. WALTERS, H. J. 1963. Leguminous hosts of soybean mosaic virus. Plant Dis. Reptr. 47:726–728.

Seven new species of legumes were found to be systemically susceptible to soybean mosaic virus (SMV). These were *Canavalia ensiformis, Cyamopsis tetragonoloba, Glycine ussuriensis, Lespedeza stipulacea* cv. Korean and Climax, *L. striata* cv. Kobe, *Phaseolus lunatus* cv. Henderson Bush Lima, and *Stizolobium deering* cv. Early Speckled. *Lupinus albus* and *P. lathyroides* were confirmed as hosts. The virus was recovered from only the inoculated leaves of several cultivars of *P. vulgaris* with local lesions followed by veinal necrosis present in the cultivar Idaho Refugee. *Vigna sinensis* was only locally infected. Temperature under which the test plants were grown had a marked effect on the symptoms produced. At 20 C symptoms were more severe in most test plants than in plants grown at 27 C.

2148. WALTERS, H. J. 1964. Transmission of bean pod mottle virus by bean leaf beetles. Phytopathology 54:240.

Ceratoma trifurcata transmitted the virus from naturally infected soybeans to beans and soybeans.

2149. WALTERS, H. J. 1964. Tobacco ringspot virus disease of soybeans. Arkansas Farm Res. 13(1):3.

A popular article. Infected plants at first show noticeable curling of terminal buds to form a crook; later the buds die. Infected plants are stunted and may not produce seeds. Maximum yield reduction occurs when plants are inoculated at primary leaf stage. There are varietal differences with regard to yield losses.

2150. WALTERS, H. J., and F. N. LEE. 1969. Transmission of bean pod mottle virus from *Desmodium paniculatum* to soybean by the bean leaf beetle. Plant Dis. Reptr. 53:411.

Bean pod mottle virus was transmitted by bean leaf beetles, from *Desmodium paniculatum* to soybeans. It is suspected that *Desmodium* spp. may act as reservoir hosts of virus, as source of primary inoculum for soybean infection.

2151. WALTERS, H. J. 1970. Bean pod mottle virus disease of soybeans. Arkansas Farm Res. 19(2):8.

A popular article. Bean pod mottle virus infecting soybeans is found commonly in Arkansas. The number of plants infected in a field range from 1–100%. Symptoms of the disease are most obvious during the rapid plant growth. During periods of hot weather the symptoms are masked. The disease may reduce yields up to 33%, due to reduced seed size and decreased pod set. The virus increases the seed mottling caused by soybean mosaic virus.

2152. WALTERS, H. J., F. N. LEE, and K. E. JACKSON. 1972. Overwintering of bean pod mottle virus in bean leaf beetles. Phytopathology 62:808. (Abstr.)

Bean leaf beetles were collected during the winter months from duff or trash in or near fields where a high percentage of soybean plants had been infected with bean pod mottle virus (BPMV) the previous season. Single beetles were transferred to individual soybean seedlings and then left for a minimum of 24 hr. or until they fed or died. The following numbers of beetles collected on various dates, which fed on test plants, transmitted BPMV: 6 January 1969, 1/43; 24 March 1969, 1/87; 5 April 1969, 3/34; 15 December 1969, 3/35; 16 January 1970, 0/41; 29 January 1970, 0/77; 11 February 1970, 11/64; 26 February 1970, 1/113; 25 March 1970, 4/158; and 15 April 1970, 0/125. Although the percentage of virus transmissions by beetles was low, sufficient transmissions occurred so that primary infection of virus could be established in volunteer soybeans and other available hosts in the spring. Generally, beetles collected

at below freezing temperatures required 5–10 days to feed, whereas those collected at warmer temperatures required less time. It appears that BPMV overwinters in hibernating beetles, although it is possible that the virus is acquired during winter months by feeding of the beetles on the underground parts of infected dormant plants.

2153. WALTERS, H. J., and P. SURIN. 1973. Transmission and host range studies of broad bean mottle virus. Plant Dis. Reptr. 57:833–836.

A low percentage of transmission of broad bean mottle virus (BBMV) occurred with three of five beetle species tested. The spotted cucumber beetle transmitted the virus only during the first 24 hr. following an acquisition feeding. Only plant species in the family Leguminosae became systemically infected with the virus. Many cultivars of bean and soybean developed local lesions.

2154. WALTERS, H. J. 1972. High-temperature seedling disease observed on soybeans in Arkansas. Arkansas Farm Res. 21(4):7.

The disease caused by *Pythium aphenidermatum* was first observed in 1966. It caused severe damage in Arkansas. The fungus may cause seed rot or pre- and post-emergence damping-off of young seedlings. Infected plants that survive are dwarfed. The first symptoms on emerged plants appear when temperatures are 90 F or above. The uppermost trifoliolate of seedlings turns upward with the middle leaflet bent over. Roots are grayish brown. Most damage occurs in late-planted crops. The disease was reproduced at temperatures above 90 F. At 80 F or below, very little disease developed.

2155. WANG, C. N. 1942. Manual of the plant diseases of Honan province [in Chinese]. Honan Univ., Honan, China. 60 pp.

2156. WANG, C. 1961. Chemical control of soybean rust [in Chinese, English summary]. Agr. Assoc. China (Taiwan) J. 35:51–54.

In experiments to test the effect of fungicides in 1959 and 1960, dithane Z-78 gave the highest yield. Good control was also obtained with two sprays of phygon XL, karathane WD, copper or zineb, or three sprays of 2% bordeaux mixture.

2157. WARREN, H. L. 1969. *Fusarium* species in soil related to continuous culture of cereals and soybean. Phytopathology 59:1056. (Abstr.)

Corn, oats, wheat, and soybean were grown continuously in field plots. Treatments consisted of residue retained and residue removed with and without fertilizer (200 lb./acre, NPK 5:20:20). *Fusarium* populations were counted on PCNB-agar from roots, rhizosphere, and soil. On roots, a high C:N ratio plus fertilizer (1) gave low counts of *F. oxysporum* for corn, oats, and soybean, but high counts for wheat, and (2) gave high counts of *F. roseum* for corn, oats and soybean, but low counts for wheat. With a low C:N ratio, fertilizer favored *F. oxysporum* on roots of all but wheat, and *F. roseum* in corn and wheat only. In the rhizosphere, high C:N ratio plus fertilizer did not affect *F. oxysporum* in cereals or *F. roseum* on corn and oats, but *F. roseum* was high in wheat and low in soybeans. For rhizosphere to soil (R:S) ratios, *F. oxysporum* was less than 1 without fertilizer at all C:N ratios. For *F. roseum* and high C:N ratios, R:S ratios were less than 1 for corn and oats and more than 1 for all crops without fertilizer; with low C:N ratios, R:S ratios were 4:1 for corn and wheat with fertilizer but 1 or less without fertilizer.

2158. WARREN, H. L., and T. KOMMEDAHL. 1973. *Fusarium* species in roots and soil associated with monoculture of soybeans in Minnesota. Plant Dis. Reptr. 57: 912–914.

Five *Fusarium* spp. were isolated from roots, rhizosphere, and plant residues of soybean and from soil of a soybean field. During 2 years, *F. oxysporum* comprised 57–82% of the isolates; *F. solani,* 16–33%; *F. roseum, avenaceum, graminearum,* and *equiseti,* 1–8%; and *F. tricinctum* and *F. episphaeria* together, less than 5%. Fertilizer or plant residue had no appreciable effect on disease prevalence.

2159. WATERHOUSE, G. M. 1947. The fungi of Bermuda. Dept. Agr. Bermuda Bull. 23. Commonw. Mycol. Inst., Mycol. Papers 92. 22 pp.

2160. WATERSON, J. M. 1947. The fungi of Bermuda. Bermuda Dept. Agr. Bull. 23.

Records on soybean *Macrophomina phaseoli* (= *M. phaseolina*), *Peronospora manshurica, Phyllosticta sojaecola,* and *Pseudomonas glycinea.*

2161. WATERSON, J. M. 1939. Annotated list of diseases of cultivated plants in Bermuda. Bermuda Dept. Agr. Bull. 18. 38 pp.

Reports dates of collections of *Peronospora manshurica* in 1927, *Phoma* sp. in 1923, *Macrophomina phaseoli* (= *M. phaseolina*) in 1927, and an undetermined bacterial spot in 1934.

2162. WATKINS, G. M. 1944. Plant diseases observed in Texas during 1943. Plant Dis. Reptr. Suppl. 149:326–338.

Reporting *Macrophomina phaseoli* (= *M. phaseolina*), *Phymatotrichum omnivorum, Pseudomonas glycinea* and *Xanthomonas phaseoli* var. *sojense.*

2163. WATSON, D. R. W. 1970. Bacterial blight of soybean in New Zealand. Plant Dis. Reptr. 54:86–88.

Bacterial blight of soybean caused by *Pseudomonas glycinea* is recorded from New Zealand for the first time.

2164. WEBBER, A. J., JR., and K. R. BARKER. 1967. Biology of the pseudo root-knot nematode *Hysoperine ottersoni*. Phytopathology 57:723–728.

In a host range study *Hysoperine ottersoni* failed to reproduce on soybean cultivar Chippewa.

2165. WEBER, C. R., J. M. DUNLEAVY, and W. R. FEHR. 1966. Influence of brown stem rot on agronomic performance of soybeans. Agron. J. 58:519–522.

The performance of six soybean cultivars was evaluated on brown stem rot (*Cephalosporium gregatum*) infested and noninfested soils for 3 years at Ames and 2 years at Cresco, Iowa. Three cultivars, corresponding to early, midseason, and late maturity, were used at each location. The use of corn yields as an index of soil productivity level appeared to be a useful technique for measuring effects of the disease where infested and noninfested areas were near but not adjacent to one another. Soybeans grown on infested soils at the two locations averaged 1 in. taller, 2 days earlier in maturity, 8% less susceptible to lodging, 0.1 g/100 seeds smaller in seed size, 10.4% lower in seed number, and 2.0 cu. wt. per acre (11.0%) lower in yield than soybeans grown on noninfested soil. Largest seed yield reduction from brown stem rot occurred in later-maturing cultivars and may be the result of the length of time plants are diseased and of increased disease severity. About 94% of the yield loss was from seed number reduction, with 6% attributable to seed size reduction. Since there is no appreciable resistance to brown stem rot, evaluation of soybean cultivars should be conducted on noninfested soil to permit maximum expression of their genetic potential.

2166. WEHMEYER, L. E. 1933. The genus *Diaporthe* Nitschke and its segregates. Univ. Michigan Press. 349 pp.

Diaporthe sojae is renamed *D. phaseolorum* var. *sojae*.

2167. WEI, C. T. 1934. Rhizoctonia sheath blight of rice. Coll. Agr. Univ. Nanking Bull. (n.s.) 15.

Rhizoctonia solani, isolated from rice, infected soybean in inoculation tests.

2168. WEI, C. T., and S. HWANG. 1939. A check list of fungi deposited in the mycological herbarium of the University of Nanking. I. (1934–1937). Nanking J. 9: 329–372.

Specimens received from Chinese provinces were *Colletotrichum glycines* and *Septoria sojina* from Kiangsu; *Peronospora manshurica* from Chekiang, Hopeh and Kiangsu; and *Uredo sojae* (= *Phakopsora pachyrhizi*) from Chekiang.

2169. WEI, C. T. 1950. Notes on *Corynespora*. Commonw. Mycol. Inst., Mycol. Papers 34:1–9.

Reduces *Cercospora vignicola* Kawam. and *Helminthosporium vignae* Olive to synonyms of *Corynespora cassiicola* (Berk and Curt.) Wei.

2170. WEIMER, J. L. 1947. Disease survey of soybean nurseries in the South. Plant Dis. Reptr. Suppl. 168:27–53.

A disease survey of soybean nurseries consisting of 20-ft. randomized rows of each cultivar, located in Alabama, Georgia, Louisiana, Mississippi, and South Carolina was made each year from 1944–1946. Information was obtained regarding diseases present and their severity, and resistance of cultivars. Disease readings were made once or twice during the latter part of the growing season, using a rating scale of 0–5. Data are presented in 16 tables. It is indicated that cultivars Ogden, CNS, Palmelton, Cherokee, and probably Louisiana Green and Dortchsoy #2, possess greater relative resistance to bacterial pustule-blight complex. Use of Ogden and CNS as breeding stock is suggested. These cultivars were also found resistant to wildfire. Cultivars Roanoke, Volslate, F.C. 30261-1 and Woods Yellow showed resistance to frog-eye leaf spot. Downy mildew, pod and stem blight, charcoal rot, sclerotial blight, anthracnose, Phyllosticta leaf spot, bud blight, mosaic, Allimara, and an unknown virus disease were also present.

2171. WEIMER, J. L. 1950. Blackpatch of soybean and other forage legumes. Phytopathology 40:782–784.

The disease is caused by a sterile fungus which produces lesions on soybean and a number of other legumes, resembling those of frog-eye leaf spot but more angular and less regular in size and having dark brown to black aerial hyphal strands of causal fungus on the surface.

2172. WEISS, F. 1945. Viruses described primarily on leguminous vegetable and forage crops. Plant Dis. Reptr. Suppl. 154:32–80.

Top necrosis, bud blight, and streak is characterized by distortion, brittleness and necrosis of shoot tip, necrosis of young and bronzing of old leaves, general stunting and blighting of buds, and marked reductions in number and size of pod. The disease is caused by tobacco ring spot virus which is sap-transmissible to soybeans.

2173. WEISS, F. 1946. Check list revision. Plant Dis. Reptr. 30:130–137.

Lists all the diseases, 47 in total, hitherto known to occur on soybeans in the United States.

2174. WEISS, M. G. 1949. Soybeans. Adv. Agron. 1: 77–157.

Includes a brief review of recent literature, chiefly North American, on the following pathogens of soybean: *Diaporthe phaseolorum* var. *batatatis* (= *D. p.* var. *caulivora*), *D. p.* var. *sojae, Cephalosporium gregatum, Glomerella glycines, Macrophomina phaseolina, Sclerotium rolfsii, Fusarium oxysporum* f. *tracheiphilum, Sclerotinia*

(= *Whetzelinia*) *sclerotiorum*, *Pythium debaryanum*, *Septoria glycines*, *Cercospora daizu* (= *C. sojina*), *Peronospora manshurica*, *Xanthomonas phaseoli* var. *sojense*, *Pseudomonas glycinea*, *P. tabaci*, tobacco ring spot virus, mosaic virus, bean yellow mosaic virus and *Heterodera marioni*.

2175. WEISS, M. G. 1950. The soybean improvement program. Soybean Dig. 10(11):34–35.

Emphasizing the need for extended study on the pathology of soybeans in connection with the improvement program, the writer states that types have been discovered showing a high degree of genetic resistance to the bacterial diseases, blight (*Pseudomonas glycinea*), pustule (*Xanthomonas phaseoli* var. *sojense*), and wildfire (*P. tabaci*). In the southern United States, where pustule and wildfire are particularly destructive, arrangements are in hand for the release of cultivars equal to Ogden and Roanoke in respect to agronomic characters and seed composition resistant to the pathogens, which have caused yield reductions up to 10% in plot trials. Genetic resistance to most other diseases affecting the crop is not clear-cut, but on a recent trip through the South, differences in strain reaction to every pathogen observed were apparent. Pending further research, only such cultivars will be released as show no marked susceptibility to any of the more serious diseases.

2176. WEISS, M. G. 1951. More and better soybeans through research. Soybean Dig. 11(11):24–25.

During 1950 the area occupied by soybeans (15 million acres) and production of 287 million bushels exceeded all previous records in the United States. At the same time two diseases, hitherto of little significance, became prevalent throughout the south. They were target spot (*Corynespora cassiicola*) and frog-eye leaf spot (*Cercospora sojina*), which was believed to be confined to southern Indiana and Illinois. Phyllosticta leaf spot also appeared early in the season, but its advance was arrested by the drought prevailing during the summer in all southern areas. Genetic resistance to many soybean diseases is now available to breeders, though for the most part it has not yet been incorporated into agronomically acceptable cultivars. Much more work is needed, however, on other potentially serious diseases, resistance to some of which has not yet been found within the soybean genus.

2177. WELCH, A. W. 1946. A study of soybean diseases and their control. Iowa Agr. Expt. Sta. Rpt. Agr. Res. for the year ending June 30, 1946. Part 1, pp. 191–193.

Seed treatment with arasan, ceresan, and spergon failed to increase emergence and stand. No detrimental effect of seed treatment was found on nodulation. The ascogenous stage of *Diaporthe sojae* (= *D. phaseolorum* var. *sojae*) was observed on old stems overwintered in the field. The best medium for its pycnidial formation was sterilized soybean seed coats. When mixed with soil and held at 10 F the bacterial pustule organism produced infection after 69 weeks and the bacterial blight organism after 45 weeks.

2178. WELCH, A. W. 1947. A study of soybean diseases and their control. Iowa Agr. Expt. Sta. Rpt. Agr. Res. for the year ending June 30, 1947. Part 1, pp. 170–171.

Investigations of the pod and stem blight disease resulted in the differentiation of two types of diseases. The pod and stem blight is caused by *Diaporthe phaseolorum* var. *sojae*, a heterothallic species. The stem canker is caused by *Diaporthe arctii*, a homothallic and more virulent species. *Pythium* and *Rhizoctonia* caused serious damage in the greenhouse under controlled conditions. Arasan seed treatment gave highly significant increase in emergence, but it affects seed inoculation with nodulating bacteria. Three species of *Glomerella* were isolated. Bacterial blight was present but not serious. Septoria leaf spot caused serious defoliation. Downy mildew and Sclerotinia blight were relatively rare and mosaic and bud blight were unimportant.

2179. WELCH, A. W. 1947. Natural and cultural occurrence of the ascogenous stage of *Diaporthe phaseolorum* var. *sojae*. Phytopathology 37:23. (Abstr.)

An abstract of entry 2180.

2180. WELCH, A. W., and J. C. GILMAN. 1948. Hetero- and homothallic types of *Diaporthe* on soybeans. Phytopathology 38:628–637.

In the course of investigations of soybean diseases, two members of the genus *Diaporthe* were found that were different relative to pathogenicity and type of perithecial development. One was heterothallic with scattered single perithecia and the other was homothallic with caespitose clusters of perithecia. The former produced typical *Phomopsis* conidia of the alpha and beta types; the latter lacked conidial stages. The heterothallic form was recognized as *Diaporthe phaseolorum* var. *sojae*; the homothallic as *Diaporthe phaseolorum* var. *caulivora*. The latter cultivar actively attacked soybean stems, girdling them and causing the plants to wilt and die. The former cultivar was less pathogenic, attacking mainly mature plants and producing linear rows of pycnidia on branches and stems.

2181. WHITE, J. C., J. F. NICHOLSON, and J. B. SINCLAIR. 1972. Effect of soil temperatures and *Pseudomonas glycinea* on emergence and growth of soybean seedlings. Phytopathology 62:296–297.

An isolate of *Pseudomonas glycinea* from soybean significantly reduced emergence of inoculated Amsoy soybean seed at constant soil temperatures of 20, 25, 30, and 35 C, with the greatest reduction occurring at 35 C. Mean height of 6-day-old seedlings from inoculated seed was significantly less than from noninoculated seed only at 25 C. There were no significant differences between the

mean dry weight of seedlings of inoculated or noninoculated seed. Isolates similar to the one used for these studies may be an important factor in evaluating soybean seed quality.

2182. WHITEHEAD, A. G., M. A. LEDGER, and L. KARIUKI. 1963. Plant nematology. East African Agr. and For. Res. Org. Ann. Rpt. 1962, pp. 54–56.

Distribution of *Meloidogyne* spp. in East Africa is tabulated. Twenty isolates of *Meloidogyne* spp. from Tanganyika were tested on soybeans. Cultivar Rhodesian ex Seatondal has high resistance to some isolates and susceptibility to others.

2183. WHITEHEAD, M. D., A. L. MATSON, and L. F. WILLIAMS. 1956. Severe root-knot nematode infection of the soybean variety Lee. Plant Dis. Reptr. 40: 176.

Lee cultivar of soybean was highly susceptible to *Meloidogyne arenaria* in Dunklin County, Missouri. No galls were observed on 11 other cultivars in a field test.

2184. WHITEHEAD, M. D., and M. J. THIRUMALACHAR. 1960. An undescribed smut disease of soybeans. Mycologia 52:189–192.

A new species of smut found infecting soybeans is described as *Melanopsichium missouriense*. The soybean pod is consumed and a gall of hard, charcoal-like consistency is formed. Chlamydospores, resembling as to spore form, echinulations, and other characters, those formed in the galls, develop readily in culture. Chlamydospores germinate, forming promycelia bearing sporidia both laterally and terminally.

2185. WHITEHEAD, M. D. 1966. Stem canker and blight of birdsfoot trefoil and soybeans incited by *Diaporthe phaseolorum* var. *sojae*. Phytopathology 56:396–400.

A new disease of birdsfoot trefoil and an undescribed disease symptom expression on soybeans incited by *Diaporthe phaseolorum* var. *sojae* are described. Although it is known to incite a pod and stem blight, this pathogen has not previously been reported to produce canker-type lesions of soybeans. These observations add to the invalidity of separation of *D. phaseolorum* into the two cultivars *sojae* and *caulivora* on the basis of symptoms on soybeans. Elongate lesions with purplish-brown borders and tan centers, with numerous erumpent dark, purplish-brown pycnidia scattered over the central portion of the lesions, occur on both hosts. As the lesions enlarge, stem girdling incites sudden blighting of the upper portion of the plant. From pathological histology studies it was observed that elliptical ostiolate pycnidia develop from erumpent stromatic masses of pseudoparenchymatous cells. Pycnidiospores are extruded in droplets of ooze that may pile up at the ostioles. The pycnidia may have 1–10 ostioles.

2186. WHITESIDE, J. O. 1960. Diseases of legume crops in Southern Rhodesia. Rhodesia and Nyasaland Dept. Res. and Spec. Serv., Proc. Ann. Conf. Off. 4:52–57.

Bacterial blight (*Pseudomonas glycinea*) can be troublesome in some seasons. The bacteria can survive on dead leaves from one growing season to the next. The following were of no great importance: stem blight (*Ascochyta pisi*), root rot (*Macrophomina phaseoli* (= *M. phaseolina*) and *Sclerotium rolfsii*), and mosaic.

2187. WHITFIELD, N. T., P. L. DUKE, and L. I. MILLER. 1965. Variation in development of eleven isolates of the soybean cyst nematode, *Heterodera glycines*, on seven legumes. Virginia J. Sci. 16:314. (Abstr.)

Eleven isolates of *Heterodera glycines* (four from Virginia and one from each of seven other states) varied in their ability to develop egg-bearing females on Korean lespedeza, adzuki bean, yellow sweet clover, button clover, black medic, and ladino white clover. The Illinois 1 isolate developed females on more of the legumes than any other isolate, whereas Kentucky 1 developed the least.

2188. WHITTLE, W. O., and B. D. DRAIN. 1935. The root-knot nematode in Tennessee. Its prevalence and suggestions for control. Tennessee Agr. Expt. Sta. Circ. 54. 8 pp.

Plants were classified according to severity of infestation by root-knot nematode. Most cultivars of soybean were badly infected, but Biloxi was slightly infected and Laredo was highly resistant.

2189. WIEHE, P. O. 1953. The plant diseases of Nyasaland. Commonw. Mycol. Inst., Mycol. Papers 53. 39 pp.

Synchytrium sp., termed false rust, was found on the leaves, especially the veins, of *Glycine javanica* L., collected at Lilongwe.

2190. WIESER, W. 1956. The attractiveness of plants to larvae of root-knot nematodes. II. The effect of excised bean, eggplant, and soybean roots on *Meloidogyne hapla* Chitwood. Proc. Helminth. Soc. Washington 23: 59–64.

The roots of soybean cultivar Bansei show variation of attraction and repulsion of larvae, depending on location of root. Attractive agent is present in the living roots and repulsive agent possibly comes with decay or chemical breakdown of roots.

2191. WILCOX, J. R., and F. A. LAVIOLETTE. 1968. Seedcoat mottling response of soybean genotypes to infection with soybean mosaic virus. Phytopathology 58: 1446–1447.

Seeds of different genotypes of soybean plants, infected with soybean mosaic virus, differed in both color and extent of mottling. Those with gray or black hila had

both black and brown patches on individual seeds. Yellow hilum seeds showed brown or buff mottle, brown hilum seeds showed only brown, and both imperfect black and buff hilum seeds showed buff mottling only. There was an association between genotype of this infected plant and extent of mottling.

2192. WILCOX, J. R., and T. S. ABNEY. 1971. Association of pod and stem blight with stem breakage in soybeans. Plant Dis. Reptr. 55:776–778.

Examination of seed samples from a population study with three soybean strains revealed differences in pod and stem blight associated with plant density. *Diaporthe phaseolorum* var. *sojae* was observed on 20% of the seed from low populations (10,000–16,000 plants/acre), compared with only 1% of the seed from the high populations (185,000–300,000 plants/acre). At the low populations lateral branches were partially broken from the erect central stem and were in contact with the soil surface. Nineteen percent of the seed from these lodged branches were infected with *D. phaseolorum* var. *sojae* compared with 2% of the seed from the erect central stem of these same plants.

2193. WILCOX, J. R., and T. S. ABNEY. 1973. Effects of *Cercospora kikuchii* on soybeans. Phytopathology 63: 796–797.

Effects of *Cercospora kikuchii* were investigated on cultivars Amsoy, Shelby, Lindarin 63, Wayne, Clark 63, and Cutler. Seedling emergence from purple-stained seeds averaged 5% points lower than that from seed free of purple stain in sand-bench tests. Emergence of seedlings from purple-stained seeds planted in the field averaged 7–13% points lower than from seed free of purple stain at Worthington, Ind., and from 10–15% points lower at Lafayette, Ind. Incidence of purple-stained seed had no effect on maturity, lodging, plant height, or seed yield in these tests. Incidence of the disease in harvested seeds did not differ appreciably between plots planted with purple-stained and purple-stain-free samples.

2194. WILCOX, J. R., F. A. LAVIOLETTE, and K. L. ATHOW. 1974. Deterioration of soybean seed quality associated with delayed harvest. Plant Dis. Reptr. 58: 130–132.

Seeds of 14 soybean cultivars grown at Lafayette, Ind., in 1972 were harvested at the normal time after maturity and again after a delay of 8 to 10 weeks. The delay in harvest resulted in significant reductions in seedling emergence of 10–49% points. There was a significant increase of seed infected with *Diaporthe phaseolorum* var. *sojae* and *Alternaria* spp. associated with the delay in harvest, but not in seed infected with *Cercospora kikuchii.* The delay in harvest adversely affected early-maturing more than late-maturing cultivars. Correlation coefficients between incidence of *D. phaseolorum* var. *sojae* and seedling emergence were −.66 on the normal harvest samples and −.95 on the delayed harvest samples, both significant at the .01 probability level. Protein content of normal and delayed harvest samples did not differ significantly; oil content of delayed samples averaged 0.5% point higher than that of normal harvest samples.

2195. WILES, A. B. 1968. Cowpeas and soybeans as hosts of *Verticillium albo-atrum.* Phytopathology 58: 1072. (Abstr.)

Although *Verticillium albo-atrum* has not been reported to cause severe damage to cowpea or soybean, greenhouse studies were initiated to indicate the possible disease reaction of these crops when planted in fields where *Verticillium* had occurred on cotton. A pathogenic isolate of *V. albo-atrum* from cotton was used to determine the reaction of eight cowpea and four soybean cultivars to this organism. Roots of seedlings grown in washed sand were dipped in a macerated, liquid culture of the fungus. The plants were then reset and after 10 days disease readings were taken and isolations made from stem sections. *V. albo-atrum* caused vascular discoloration of both cowpea and soybean stems and was readily isolated from such tissues. Severe external symptoms appeared only on certain cowpea cultivars. Brown Sugar Crowder and Mississippi Crowder cowpeas were rated susceptible; Chinese Red, resistant; and others intermediate. Bragg, Hill, Lee, and Semmes soybeans were rated resistant.

2196. WILLIAMS, L. F., A. L. MATSON, and J. M. EPPS. 1963. A fourth locus effecting resistance to the cyst nematode (*Heterodera glycines*) in the soybean. Proc. Soc. Agron. Meeting, Denver, Colo. (Abstr.)

In addition to the three recessive alleles, which have been reported, a dominant allele at the fourth locus was found to be necessary for resistance to the soybean-cyst nematode. This fourth allele is closely linked to black seed coat color.

2197. WILLIAMS, T. H. 1964. [New records of diseases and fungi in Sabah.] FAO Plant Prot. Comm., South East Asia and Pacific Region, Quart. Rpt. Jan.–March 1964, p. 8.

Leaf rot (*Corticium solani*) is reported on *Glycine javanica,* the first report for Sabah (Malaya).

2198. WINSLOW, R. D. 1954. Provisional list of host plants of some root eelworms (*Heterodera* spp.). Ann. Appl. Biol. 41:591–605.

In host range tests, *Heterodera schachtii* var. *trifolii* parasitized the roots of soybeans. The beet eelworm, *H. schachtii,* and the cabbage eelworm, *H. crucifera,* failed to parasitize soybean.

2199. WINSTEAD, N. N., C. B. SKOTLAND, and J. N. SASSER. 1955. Soybean-cyst nematode in North Carolina. Plant Dis. Reptr. 39:9–11.

A description of a nematode found in the roots of soybeans is given. The cyst-forming nematode of the genus *Heterodera* was found parasitizing soybeans in southeastern North Carolina; it was identified as *H. glycines*.

2200. WINSTEAD, N. N., and C. B. SKOTLAND. 1956. Eradicant treatments for narcissus bulbs and gladiolus corms harboring soybean-cyst nematode cysts. Phytopathology 46(1):31. (Abstr.)

An abstract of entry 2201.

2201. WINSTEAD, N. N., and C. B. SKOTLAND. 1957. Eradicant treatments for narcissus bulbs and gladiolus corms harboring soybean-cyst nematode cysts. Phytopathology 47:67–69.

Several treatments, including eradicant treatments for the bulb and stem and the root-knot nematodes and a prestorage treatment for the control of Fusarium bulb and corm rots, were found lethal to the larvae and eggs in cysts of the soybean nematode. No reproduction occurred on soybean roots inoculated with cyst material steeped in hot water at 48–49 C for 30 min. or at 54–55 C for 15 min. A 0.5% formalin treatment at 45 C for 3 hr. also proved effective; however, this treatment at room temperature was not effective. Soak treatments with Na 2, 4,5-trichlorophenoxide at a concentration of 3 lb. of an 85% formulation to 100 gal. water for 15 min. or 2 lb. to 100 gal. water for 1–2 hr. was also lethal to the eggs and larvae in cysts of the soybean nematode. Two additional bulb and corm treatment materials, 97.5% phenylmercury acetate and 5% ethylmercury phosphate, were not effective.

2202. WITHROW, A. P., and J. P. BIEBEL. 1944. Nicotine fumigation injury in Biloxi soybean. Phytopathology 34:256–257.

A severe chlorosis was developed on soybean following nicotine fumigation. The symptoms were experimentally produced.

2203. WOLF, F. A. 1920. Bacterial blight of soybean. Phytopathology 10:119–132.

A bacterial blight found in North Carolina is considered to differ from the one due to *Bacterium glycineum* (= *Pseudomonas glycinea*). The organism is described as *Bacterium sojae* n.sp. Lesions on the leaves begin as small, angular water-soaked areas which enlarge and become dark brown to purplish black. The surrounding tissues are more or less chlorotic. Lesions may be present on cotyledons. Under humid conditions a bacterial exudate may collect in whitish droplets on the lower leaf surface of lesions. Infection spreads from cotyledons to leaves. When water suspension of the organism is applied to injured leaves, infection is evident in 6–7 days. Infection takes place through stomata and the organism moves intercellularly and probably becomes intracellular. Infected seeds are the chief means of overwintering. Infected leaves left in the field also harbor the pathogen.

2204. WOLF, F. A., and A. C. FOSTER. 1921. Thermal death points of some bacterial plant pathogens in relation to reaction of the media. North Carolina Agr. Expt. Sta. Tech. Bull. 20, pp. 21–24.

The concentration of hydrogen ions is an agent of great importance in cellular destruction at high temperatures in *Bacterium glycineum* (= *Pseudomonas glycinea*), *B. sojae* (= *P. glycinea*), and four other bacteria.

2205. WOLF, F. A., and I. V. SHUNK. 1921. Tolerance to acids of certain bacterial pathogens. Phytopathology 11:244–250.

Acetic acid is more toxic than other acids employed at the same pH, and a greater pH concentration in agar than in bouillon is required to inhibit growth. *Bacterium glycineum* (= *Pseudomonas glycinea*), and *B. sojae* (= *Pseudomonas glycinea*) are included as the test material.

2206. WOLF, F. A. 1922. Studies on fermentation of rare sugars by plant pathogenic bacteria. J. Elisha Mitchell Sci. Soc. 38:12–13.

Bacterium glycineum and *B. sojae* (= *Pseudomonas glycinea*) can be differentiated by their specialized fermentative action on rare sugars. The former attacks manitol and galactose, while the latter does not.

2207. WOLF, F. A. 1922. Additional hosts for *Bacterium solanacearum.* Phytopathology 12:98–99.

Soybean was found to be a natural host of *Bacterium* (= *Pseudomonas*) *solanacearum.*

2208. WOLF, F. A. 1923. Studies on the physiology of some plant pathogenic bacteria. VII. Pectic fermentation in culture media containing pectin. Phytopathology 13:381–384.

Pectic fermentation was demonstrated in *Bacterium sojae* (= *Pseudomonas glycinea*) and other bacteria.

2209. WOLF, F. A., and S. G. LEHMAN. 1924. Report of division of plant pathology. North Carolina Agr. Expt. Sta. Ann. Rpt. 47, pp. 83–85.

Soybean in North Carolina was subject to at least 12 diseases, of which about half were constantly recurring and of major importance. It is shown that *Peronospora sojae* (= *P. manshurica*) is distinct from *P. trifoliorum.* The disease is seedborne. *Colletotrichum glycineum* (= *C. dematium* f. *truncata*) is distinct from *Glomerella cingulata.* The perfect stage of the fungus occurs on decaying stems left in fields. Soybean root rot caused by *Pythium debaryanum* (?) was recorded for the first time. Brown spot (*Septoria glycines*) was found to be identical with a similar disease found in Japan.

2210. WOLF, F. A. 1924. Bacterial pustule of soybean. J. Agr. Res. 29:57–68.

Bacterial pustule disease attacks at any stage of plant growth but is most severe when plants are flowering. The symptoms appear as pustular outgrowth on either or both leaf surfaces. They are light green at first but later become brown. Tissues surrounding the pustule become chlorotic. The disease is caused by *Bacterium* (= *Xanthomonas*) *phaseoli* var. *sojense*. It forms yellow colonies on nutrient agar, is flagellated, and utilizes starch, gelatin, casein, blood serum, and asparagin. The parasite gains entrance through stomata and passes intercellularly. The pustule arises by hypertrophic changes of any of parenchymatous cells.

2211. WOLF, F. A., and S. G. LEHMAN. 1926. Brown spot disease of soybean. J. Agr. Res. 33:365–374.

The disease caused by *Septoria glycines* is characterized by brown or reddish-brown angular spots; defoliation may occur. The tissues surrounding lesions are chlorotic. On trifoliolates the spots are numerous, large, light brown, irregular, and gradually becoming dark brown to blackish brown. The morphology of the fungus is described and illustrated. Cultivars Mammoth Yellow, Haberlandt 38, Laredo, Biloxi, Lexington, Tokyo Tar Heel Black, and Chiquita showed resistance.

2212. WOLF, F. A., and S. G. LEHMAN. 1926. Diseases of soybeans which occur in North Carolina and the Orient. J. Agr. Res. 33:391–396.

A brief review of literature on the following diseases which occur in both North Carolina and eastern Asia: wilt caused by *Fusarium tracheiphilum,* downy mildew (*Peronospora manshurica*), brown spot (*Septoria glycines*), pod and stem blight (*Diaporthe sojae*) (= *D. phaseolorum* var. *sojae*), frog-eye leaf spot (*Cercospora daizu*) (= *C. sojina*), anthracnose (*Colletotrichum glycines*) (= *C. dematium* f. *truncata*), and *Glomerella glycines*). *Xanthomonas phaseoli* var. *sojense* and *Sclerotium rolfsii* are found in North Carolina but not in Asia. *Sclerotinia libertiana* (= *Whetzelinia sclerotiorum*), *Hypochnus centrifugus, Uromyces sojae* (= *Phakopsora pachyrhizi*), and *Phyllosticta sojaecola* occur in eastern Asia but not in North Carolina.

2213. WOLF, F. A. 1949. Notes on Venezuelan fungi. Lloydia 12:208–219.

In areas where irrigation is inadequate, soybeans were affected by *Macrophomina phaseoli* (= *M. phaseolina*) root rot.

2214. WOODS, M. W. 1942. Two new records for the frog-eye leaf spot: Maryland. Plant Dis. Reptr. 26:382.

Records the occurrence of frog-eye disease.

2215. WOODWORTH, C. M., and F. C. BROWN. 1920. Studies on varietal resistance and susceptibility to bacterial blight of the soybean. Phytopathology 10:68. (Abstr.)

Field observations and experiments at the University of Wisconsin during the preceding 3 or 4 years indicated that soybean cultivars vary greatly in their relative susceptibility to bacterial blight. Of 47 cultivars secured from the Agricultural Experiment Stations of Illinois, Ohio, Indiana, Kentucky, and Wisconsin and grown in 1918, about half were completely resistant and the other half ranged from complete susceptibility to partial resistance. Experimental inoculations in the greenhouse have strengthened this evidence regarding varietal differences in resistance. Cultivars Ebony, Elton, Habara, No. 8 (S.P.I. No. 20406), Mammoth Yellow, Virginia, Cloud, Wilson, Medium Yellow, and Ito San were under trial. All plants were sprayed with a water suspension of the bacterial blight organism shortly after the first compound leaf appeared. An examination 3 weeks later showed about half of the plants of the Wilson cultivar, all but three of Medium Yellow, and all of Ito San, infected. The other cultivars were completely resistant.

2216. WOODWORTH, C. M. 1924. Mottling of soybeans. J. Hered. 15:349–354.

The extent and expression of mottling on different plants are possibly controlled by genetic factors.

2217. WOOLEY, D. W., G. SCHAFFNER, and A. C. BRAUN. 1955. Studies on the structure of the phytopathogenic toxin of *Pseudomonas tabaci.* J. Biol. Chem. 215:485–493.

The phytopathogenic toxin of *Pseudomonas tabaci* has been shown to be most probably the lactone of α-lactylamino-β-hydroxy-ϵ-aminopimelic acid. The lactone is formed between the hydroxyl group of the lactic acid residue and the α-carboxyl group of the diaminohydroxypimelic acid. Several degradation products and other derivatives of this toxin have been prepared and characterized. The structural analogy of this pathogenic agent to methionine has thus been verified. Previous work had shown that methionine was a specific antagonist of the toxin, and had led to the postulation that the toxin was a naturally occurring antimetabolite of methionine.

2218. WU, L., W. TIEN, and Y. LIN. 1964. Seed-borne diseases of soybean in Taiwan. I. Factors affecting the isolation of causal organisms. Acad. Sinica Inst. Bot. (Taiwan), Bot. Bull. (n.s.) 5:42–53.

Studies on the rinsing of seed in sterile water, selection of media, application of chemicals with regard to concentration and length of time applied, and temperature for incubation were extensively carried out.

2219. WU, L., Y. LIN, and K. CHIU. 1964. Seed-borne diseases of soybean in Taiwan. II. Survey of the seed-borne pathogens from soybean seeds. Acad. Sinica Inst. Bot. (Taiwan), Bot. Bull. (n.s.) 5:105–112.

Sixteen out of 25 lots of seed samples sown grew stunted seedlings showing characteristics of bud blight (tobacco

ring spot virus). Infection was as high as 98%. *Alternaria, Cercospora, Cladosporium,* and *Fusarium* were the fungi most frequently isolated from seed, but seedlings grown on autoclaved soil did not show a comparable number of fungal infections. Other fungi isolated from the seeds were: *Cephalothecium, Colletotrichum, Cornyespora, Curvularia, Nigrospora, Penicillium, Pestalozzia, Phyllosticta, Rhizoctonia,* and *Stemphylium.*

2220. WU, L., and Y. LIN. 1967. Rhizoctonia aerial blight of soybean caused by *Thanatephorus cucumeris* (*Pellicularia sasakii*). Mem. Coll. Agr. Natl. Taiwan Univ. 9:57–69.

The disease was the most destructive on soybean in southern Taiwan in 1963, and was frequently found in the vicinity of rice fields affected by sheath blight caused by the same pathogen. Symptoms on soybean were characterized by leaf blight and necrotic leaf spots, which vary in size and shape from circular to irregular with indefinite to distinct margin, and leaves become brown. Sclerotia with light-tan mycelium frequently formed on lower sides of the leaves. Morphological and cultural characters of the fungus are described.

2221. WYLLIE, T. D., and R. W. GOTH. 1959. Treatment of soybean seed in Minnesota. Plant Dis. Reptr. 43:898–902.

In general, fair-quality seed responds more to seed treatment than does high-quality seed, particularly if soil conditions are unfavorable for germination. Majority of commercial seed lots tested responded favorably to thiram seed treatment, many did not respond, and large yield reductions occurred in some cases. No evidence of thiram injury to soybean or nodulation was found at any dosage tested.

2222. WYLLIE, T. D., and D. P. TAYLOR. 1960. Phytophthora root rot of soybeans as affected by soil temperature and *Meloidogyne hapla.* Plant Dis. Reptr. 44:543–545.

Inoculation of Harosoy soybean with *Phytophthora sojae* (= *P. megasperma* var. *sojae*) and *Meloidogyne hapla* caused more severe symptoms, as expressed by plant height, dry weight, and postemergence loss in stand, than either pathogen alone. The fungus was the primary cause of the damage with the nematode acting as a contributing factor. Damage caused by these organisms was most severe at soil temperatures above 20 C and increased as the temperature increased.

2223. WYLLIE, T. D. 1961. Host-parasite relationships between soybean and *Rhizoctonia solani.* Diss. Abstr. 21(10):2854.

Histological observations on the invasion of seedlings of Chippewa soybeans by *Rhizoctonia solani* indicated that, after initial random growth on the primary root surface, a mycelial mantle is formed which increases in density and thickness. Penetration and cellular invasion proceed between the primary and the secondary root. Similar cortical invasion occurs at wound sites; there is also invasion by direct penetration of the primary root epidermis with subsequent intra- and intercellular invasion of the cortical tissue, and discoloration of the middle lamella before mycelial invasion. Only in very severe infections does the mycelium penetrate the vascular tissues of the primary root.

The fungus apparently produces a toxin causing necrosis of seedling roots in the absence of contact with the mycelium. Symptoms varied from an almost complete necrosis of the entire root system, a partial necrosis of the primary root and some discoloration and inhibition of secondary roots, or an inhibition and necrosis of secondary roots only, to virtually no effect. Discoloration in secondary roots was present throughout the entire diameter and the whole length of the vascular cylinder to their point of origin. Host root exudates exerted an effect upon the growth habit of the mycelium, with vegetative structures that resembled infection cushions or appressorial initials appearing from shortened side branches. Emergence of seedlings was conspicuously reduced when a highly pathogenic isolate of *R. solani* was used in combination with *Meloidogyne hapla* or *M. javanica* but with only moderately pathogenic isolates there was no striking increase in root-rot severity with eelworms.

2224. WYLLIE, T. D. 1962. Effect of metabolic byproducts of *Rhizoctonia solani* on the roots of Chippewa soybean seedlings. Phytopathology 52:202–206.

Several isolates of *Rhizoctonia solani* produced a toxic substance that caused necrosis of primary and secondary roots of seedling Chippewa soybeans in the absence of physical contact between host and pathogen. The amount of necrosis varied with the particular isolate and ranged from nearly complete necrosis of the entire root system to practically no effect. Some isolates increased plant height whereas others caused slight stunting. Histological studies demonstrated that the toxin was translocated through the vascular elements of the secondary roots to their point of origin in the primary root pericycle. Diffusion through the primary root cortex, however, could be observed only 2 or 3 cell layers deep. Appressorial initials were formed by *R. solani* mycelium in response to host-root exudates of Chippewa soybeans, in the absence of physical contact between host and pathogen.

2225. WYLLIE, T. D., and L. F. WILLIAMS. 1965. The effects of temperature and leaf age on the development of lesions caused by *Peronospora manshurica* on soybeans. Phytopathology 55:166–170.

Daylight temperatures between 20 and 30 C after inoculation had no significant effect on development of lesions caused by *Peronospora manshurica* on Clark soybeans. Temperatures prior to inoculation had no significant

effect on the development of lesions when leaves of similar physiologic ages were compared. The number of lesions increased and the size of lesions decreased with increasing age of the leaves at inoculation. Therefore, a given cultivar could be rated from highly resistant to highly susceptible depending upon age of leaves at time of infection. Primary leaves that were developed by the time of emergence and through 7 days after emergence were the most suitable for obtaining consistent results, but lesion development was satisfactory on trifoliolate leaves inoculated at an early stage of development. Primary leaves are superior to trifoliolate leaves for determining physiologic races of the pathogen or for measuring host strain differences.

2226. WYLLIE, T. D., and O. H. CALVERT. 1969. Effect of flower removal and pod set on formation of sclerotia and infection of *Glycine max* by *Macrophomina phaseoli.* Phytopathology 59:1243–1245.

Infection was unaffected by flower removal, pod set, temperature, moisture, or soybean cultivar. Sclerotial formation was conditioned only by flowering and pod set and all other variables were subordinates.

2227. WYLLIE, T. D., and G. FRY. 1973. Liquid nitrogen storage of *Macrophomina phaseolina.* Plant Dis. Reptr. 57:478–480.

Two strains of *Macrophomina phaseolina* were grown on Czapek's agar plate and sclerotia from each plate were collected, tubed, and sealed for freezing in liquid N. After freezing, the ampules were opened and the sclerotia were seeded on potato-dextrose agar. The observed germination was excellent. Mycelia originating from these cultures were inoculated into the hypocotyl of 2-week-old soybean seedlings. Results indicated the cultures had retained their original level of pathogenicity over a period of 9 months.

2228. YAKHONTOV, V. V. (ed.). 1967. [Pests and diseases of fodder and Leguminosae crops.] 148 pp.

Diseases of soybean and other fodder crops in U.S.S.R. are discussed.

2229. YAMADA, S. 1961. Plant injuries caused by the soybean-cyst nematode and control measures from the view point of soil sciences [in Japanese]. Parts 1, 2, and 3. Nogyo-oyobi-Engei 36:469–474, 633–636, 797–800.

2230. YAMADA, S. 1963. Investigations on the damage of soybean nematode (*Heterodera glycines*) and its control from the view point of soil. Soil Sci. and Plant Nutr. 9:15–20.

According to investigations in the Tokachi district, it was concluded that the soil where damage by soybean nematode was severe belonged to the so-called dry type of volcanic ash soil. The population of nematodes was rather numerous; in addition, poor fertility of surface soil and the impossibility of root penetration into the subsoil owing to the formation of plowsol, indirectly promoted the damage by nematodes.

2231. YAMAMOTO, W. 1925. A new disease of soybean [in Japanese]. J. Plant Prot. (Tokyo) 12:97–99.

A new leaf spot was found in Japan. The causal fungus was tentatively referred to as *Mycosphaerella sojae.*

2232. YAMAMOTO, W., and M. MAEDA. 1960. *Cercospora* species in Japan [Taxonomic notes in Japanese]. Hyogo Univ. Agr. Sci. Rpts. Ser. Agr. Biol. 4:41–91.

Cercospora on soybeans are: *C. canescens* Ellis and Martin (syn. *C. vignicaulis* Tehon), *C. kikuchii* T. Matsu and Tomoyasu (syn. *Cercosporina kikuchii* T. Matsu and Tomoyasu), and *Cercospora sojina* Hara (syn. *C. daizu* Miura and *Cercosporina sojina* Hara).

2233. YANG, S. M. 1959. An investigation on the host range and some ecological aspects of the Sclerotinia disease of the rape plant [in Chinese, English summary]. Acta Phytopath. Sinica 5:111–122.

Sclerotinia (= *Whetzelinia*) *sclerotiorum* infects soybean in China.

2234. YANG, W., and L.-C. WU. 1971. Tolerance to PCNB and pathogenic strength of *Sclerotium rolfsii* Sacc. Mem. Coll. Agr. Natl. Taiwan Univ. 12:191–202.

2235. YERKES, W. D., and G. PATINO. 1960. The severe bean mosaic virus, a new bean virus from Mexico. Phytopathology 50:334–338.

A new mosaic disease of beans from Mexico has field symptoms similar to those of common bean mosaic virus, but are more severe. Mechanically inoculated leaves develop local lesions as necrotic spots, vein necrosis, or ring spots, dependent on the cultivar. All inoculated plants develop systemic leaf mottle. The host range includes all tested cultivars of *Phaseolus vulgaris, P. lunatus, Glycine max,* and *Vigna sinensis.* Symptomless carriers include *Lathyrus odoratus, Pisum sativum,* and *Vicia sativa. Cucumis* sp., *Lycopersicum esculentum,* and *Nicotiana* spp. are nonsusceptible. The virus is not seedborne. It withstands heating to 92 C, dilution to 1:4,000,000, and aging of over 7 months in dried tissues, 11 weeks as expressed juice, and 10 weeks as frozen juice. The virus is also quite resistant to treatment with protein-precipitating and oxidizing agents.

2236. YOKOGI, K. 1927. On the Hypochnus disease of soybeans and its comparison with that of rice plants [in Japanese]. J. Plant Prot. (Tokyo) 14:146–158.

Both *Hypochnus sasakii* and *H. centrifugus* are known to be pathogenic to soybeans in Japan. Morphological studies and cross-inoculation tests on the two fungi from both rice and soybean revealed no significant difference, and accordingly it was considered that only one species

was involved. Optimum temperature for growth of the fungus was found to be 30 C, and for sclerotial development, 28 C.

2237. YOKOGI, K. 1927. Studies on the Hypochnus disease of *Sesamum indicum* and the pathogenicity of its causal organism to rice plants and soybeans [in Japanese]. Agr. and Hort. 2:487–500.

Hypochnus centrifugus isolated from sesamum is pathogenic to soybean.

2238. YOKOO, T. 1936. Host plants of *Heterodera schachtii* Schmidt and some instructions. Korea Agr. Expt. Sta. Bull. 8(2/3):167–174.

It is reported that the soybean-cyst nematode has been observed in Korea.

2239. YOKOO, T. 1951. Golden nematode and its relative [in Japanese]. Ann. Phytopath. Soc. Japan 15(3/4): 166–167. (Abstr.)

The paper lists soybeans as a host of a cyst-forming nematode. The author considered the soybean-cyst nematode to be *Heterodera gottingiana.*

2240. YOSHII, H., and S. SASAKI. 1926. [Mummy disease of soybean.] J. Plant Prot. (Tokyo) 14:524–525.

Phomopsis sp. caused mummification of soybean seeds in Korea.

2241. YOSHII, H. 1927. Crop diseases in 1926 [in Japanese]. Ann. Agr. Expt. Sta. Chosen 7:21–34.

Includes *Phomopsis* sp., and *Cercospora kikuchii,* brown seed, *Septoria glycines,* and mosaic on soybean.

2242. YOSHIMEKI, M., K. KOBASHI, and T. SASAKI. Analytical study of injury by the soybean-cyst nematode *Heterodera glycines* Ichinohe [in Japanese, English summary]. Inst. Agr. Res. Bull. Tohoku Univ. 7(3):179–183.

To clarify the extent of injury caused by the soybean-cyst nematode on vegetative and generative growth of the soybean plant, damage control on plants was obtained from the soybean field. Plant height, number of nodes, number of branches, number of pods, number of beans, percentage of matured grains, and weight of 100 beans were examined.

2243. YOSHIMEKI, M., and T. SASAKI. 1956. Analytical study of injury by the soybean root miner with special reference to the further injury by the soybean-cyst nematode or rat [in Japanese, English summary]. Inst. Agr. Res. Bull. Tohoku Univ. 7(3):185–190.

The samples examined in the present work were obtained from a soybean field at Ahiwahime village and Toyaski village in Miyagi Prefecture to analyze the injury caused by the soybean root miner and further injury by the soybean-cyst nematode or the rat to the growth of the soybean plant.

2244. YOSHINO, K. 1905. A list of the parasitic fungi collected in the Province of Higo (Japan) [in Japanese]. Bot. Mag. (Tokyo) 19:87–103, 199–222.

Records occurrence on soybeans of *Ascochyta* sp., *Cercospora* sp., *Gloeosporium* sp., *Hypochnus cucumeris, Isariopsis griseola, Nectria ipomeae,* and *Peronospora viciae.*

2245. YOUNG, J. R., and R. D. RIGGS. 1964. Identification of the amino acids of nematode resistant and susceptible soybeans. Proc. Arkansas Acad. Sci. 18:46–49.

The free amino acid pools of various soybean cultivars and lines were investigated by two-dimensional chromatographic methods. Comparisons were made between soybean-cyst nematode resistant and susceptible cultivars. No consistent quantitative differences were observed, and exact quantitative measurements were not made.

2246. YOUNG, P. A. 1944. Epidemic of charcoal rot of corn and other crops in East Texas. Plant Dis. Reptr. 28:898–899.

Soybean was attacked by *Macrophomina phaseoli* (= *M. phaseolina*).

2247. YOUNG, P. A. 1949. Symptoms and resistance of crop plants to charcoal rot and ashy stem blight. Phytopathology 39:27.

Soybean was rated as very susceptible to *Macrophomina phaseoli* (= *M. phaseolina*).

2248. YU, T. F. 1939. A list of plant viruses observed in China. Phytopathology 29:459–461.

Soybean mosaic is widespread in all important soybean-growing regions of China and causes heavy damage.

2249. YU, T. F. 1940. A list of important crop diseases occurring in Kiangsu province (1934–1937). Lingnan Sci. J. 19:67–68.

2250. YU, T. F. 1955. A preliminary list of *Fusaria* in China [in Chinese, English summary]. Acta Phytopath. Sinica 1:1–18.

Cites the occurrence of *Fusarium bulbigenum* var. *tracheiphilum.*

2251. YUHARA, I., and H. INAGAKI. 1963. Studies on the resistance of soybean plants to the soybean-cyst nematode, *Heterodera glycines.* II. The relations between the development of larvae invaded in the roots and the resistance of soybean cultivars [in Japanese, English summary]. Hokkaido Natl. Agr. Expt. Sta. Res. Bull. 80, pp. 94–102.

This paper discusses the results of experiments on the mechanism of varietal differences for resistance to the soybean-cyst nematode, *Heterodera glycines.*

2252. YUROVA, N. F. 1962. [On the systematic position of the genus *Phytophthora*.] Bot. Zhur. (SSSR).

2253. ZAIANCHKOVSKAIA, M. S. 1938. Diseases of soybeans in the Ukraine [in Russian]. Moscow Vsesoiuz. Nauch.-Issled. Inst. Severnogo Zernovogo Khoz. i Zernobob. Kul'tur, Trudy 3:5–22.

Notes are given on *Alternaria* sp., at times semiparasitic on leaves; *Ascochyta sojaecola* on wilting plants; *Bacterium sojae* Wolf, causes cotyledon bacteriosis and rusty leaf spot; *Fusarium* spp., on cotyledons and semiparasitic or saprophytic on seeds; *Fusarium tracheiphilum,* causes wilt; *Peronospora manshurica,* isolated from wilting plants; *Phyllosticta sojaecola* Mass., on wilting plants; (crimped leaves), a virus that causes unequal development of the leaflet lamina along middle and lateral veins; and (leaf roll) a virus that causes the edge of the leaf to turn downwards.

2254. ZALASKY, H. 1954. Infection studies in *Septoria glycines* Hemmi. Proc. Canad. Phytopath. Soc. 22: 19. (Abstr.)

2255. ZAUMEYER, W. J. 1938. A streak disease of peas and its relation to several strains of alfalfa mosaic virus. J. Agr. Res. 56:747–772.

Three strains of alfalfa mosaic virus can infect soybean but pea streak virus cannot.

2256. ZAUMEYER, W. J., and L. L. HARTER. 1943. Two new virus diseases of beans. J. Agr. Res. 67:305–328.

Soybean was susceptible to bean mosaic viruses 4 and 4A by artificial inoculation.

2257. ZAUMEYER, W. J., and H. R. THOMAS. 1948. Pod mottle, a virus of beans. J. Agr. Res. 77:81–96.

During the host range studies of newly discovered bean pod mottle virus of *Phaseolus vulgaris,* 11 cultivars of soybean were the only other susceptible hosts found among 25 species representing 20 genera in 9 families.

2258. ZAUMEYER, W. J., and H. R. THOMAS. 1950. Yellow stipple, a virus disease of bean. Phytopathology 40:847–859.

Yellow stipple virus of beans when inoculated in soybeans produced intense mottling in cultivars Arksoy and Ralsoy, moderate mottling in cultivar Burdette, very mild mottling in Cherokee, and local lesions on cultivars Biloxi, CNS, Gibson, Illini, and Lincoln.

2259. ZAUMEYER, W. J., and H. R. THOMAS. 1957. A monographic study of bean diseases and methods for their control. U.S. Dept. Agr. Tech. Bull. 868. 250 pp.

2260. ZAUMEYER, W. J., and C. PATINO. 1959. A recently discovered virus-induced streak of peas. Plant Dis. Reptr. 43:698–704.

The virus when inoculated in soybean cultivars Jackson, Ogden, and Roanoke, produced yellow stipple-like mottling and green veinbanding.

2261. ZEVADA, M. Z., W. D. YERKES, JR., and J. S. NIEDERHAUSER. 1955. First list of fungi of Mexico. Arranged by hosts [in Spanish]. Mex. Ofic. de Estud. Espec. Fol. Tec. 14. 43 pp.

Reports occurrence of *Pellicularia filamentosa* on soybean.

2262. ZHUKOVSKAYA, S. A. 1968. Wilting of leguminous plants [in Russian]. Zashch Rast. Mosk. 13:45–46.

The disease caused by *Gliocladium roseum* was observed on several cultivars of soybeans in Soviet Far East during 1964–1965. In 1965, infection was severe during the 10 days of August after dry and cold weather. The mycelium developed in the vessels and penetrated the exodermis.

2263. ZSCHAU, K. 1964. A contribution to the occurrence of alfalfa mosaic virus in Germany [in German]. Nachrichtenbl. f. den Deut. Pflanzenschutzd. (Berlin) N.F. 18:44–48.

On the cultivar Black Eye, inoculation of an isolate from *Melilotus alba* caused pinhead-sized, dark-brown, necrotic, local lesions, with no systemic reaction. An isolate from *Chenopodium album* caused vein necrosis of the inoculated leaves and a systemic reaction of chlorosis of the entire plant.

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